BMI

PowerScope User's Guide

A17646

INDEFINITE

Copyright

© 1987 Basic Measuring Instruments. All rights reserved.
PowerScope® is a registered trademark of Basic Measuring Instruments.

Operators Safety Summary

Warning : This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the User's Guide, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against each interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

The servicing instructions in this manual are for use by qualified personnel only. To reduce the risk of electrical shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

Incoming ground: The power plug is grounded. For continued protection against risk of electrical shock and fire, do not defeat the grounded plug.

Ventilation: This unit is fan cooled. For continued protection against risk of electrical shock and possible fire hazard, do not allow the fan opening to become blocked.

Symbols as marked on equipment:

⚠ 600 V MAX	This symbol indicates maximum input voltage to instrument not to exceed 600 Vrms.
⏚	Protective ground (earth) terminal.

UL File Number E95890
Hewlett Packard Divisional Purchase Agreement #125
Digital Equipment Company Part Number FC-10118 AC
General Services Administration Contract Number GS00F93673

WARNING
The installation instructions in this manual are for use by qualified personnel only.
Do not install this instrument on a power line unless you are qualified to do so.
High voltages that cause burns and lethal shocks are present during power monitoring. When making connections to power lines, always connect the safety earth ground first. USE STANDARD HIGH-VOLTAGE, HIGH-CURRENT SAFETY PRECAUTIONS.

PROPERTY OF UNISYS
2276 HIGHCREST ROAD
ROSEVILLE, MN 55113

BMI.

6-12-95

$$\text{Fundamental}_{RMS} = I_{RMS_{TOTAL}} / \sqrt{THD^2 + 1}$$

where THD = decimal, i.e. 10% = 0.10

Harmonics as % of fundamental are RMS.

Amplitudes in IEC 1000-3-2 are RMS.

Kirk

Fifteen Month Limited Warranty

In the event of manufacturing defects, BMI will repair or exchange parts for this product free of charge for fifteen months after original purchase. This warranty covers normal usage and does not cover damage which occurs in shipment or damage which results from accident, misuse, or neglect. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

If you need service

1. Call BMI's Customer Service Department at our toll free number to obtain a Return Authorization number.
2. Using the original packaging, send the product prepaid and adequately insured to the address below.
3. Enclose a note detailing the problem and include the name and phone number of the person responsible for the return.
4. Non-warranty repair estimates will be provided by BMI after the product is received.
5. Warranty repairs must be accompanied by proof of date of original purchase.

Model # A-112 Serial # 1272 Ship Date 7/28/88

BMI
Basic Measuring Instruments
335 Lakeside Drive
Foster City, CA 94404

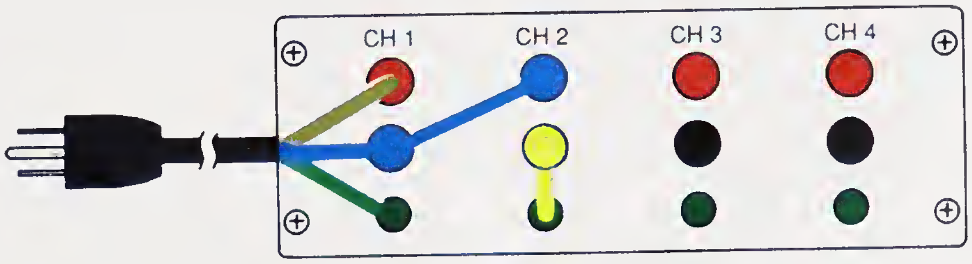
Outside California: (800) 634-1233

California: (800) 451-3040

BMI Powerscope Setup
(Typical Setup for Single Phase 208V)

Plug in BMI Powerscope
[After initial checks, unit should indicate IDLE.]

Connect AC line to the powerscope.



This setup monitors:
Line – Neutral (or Line – Line) voltage on channel 1.
Neutral – GND (or Line – GND) voltage on channel 2.

Press Status key to Monitor the line and verify the readings are within the ranges specified in the Setup Menu

Press Monitor to start monitoring the AC line.

Tip: Immediately press the up arrow to suppress printing threshold reports and initial waveshapes.

Press Setup Menu

Press down arrow to step through the menu items.

Press value up or value down keys to select the type.

Type: Ind Channels
Ch Setup: 1
Mode: AC
Name: Channel 1
Nom. Freq: 60.0 Hz
Freq. Tol: 1.2Hz
Surge Volt: 230Vrms
Sag Volt: 200Vrms
Impulse thr: 230Vpk
Hi Freq Noise: 10Vpk

Enter values via the keypad.

Ch Setup: 2
Mode: AC
Name: Channel 2
Nom. Freq: 60.0 Hz
Freq. Tol: 1.2Hz
Surge Volt: 230Vrms
Sag Volt: 200Vrms
Impulse thr: 230Vpk
Hi Freq Noise: 10Vpk

Enter values via the keypad.

Ch Setup: 3
Mode: Off
Ch Setup: 4
Mode: Off

BMI Model 4800 PowerScope.

Power line disturbances disrupt and damage today's sophisticated electronic equipment.

The PowerScope is a portable instrument that detects power line disturbances, analyzes them, identifies their cause, and selects a solution.

Wherever electronic equipment reliability is required, the PowerScope's unique graphic reports, patented detection systems, and powerful multi-processor architecture make it an essential tool.

BASIC MEASURING INSTRUMENTS
335 LAKESIDE DRIVE
FOSTER CITY, CA 94404-1147
TWX 910/374-3059
FAX 415/574-2176

TELEPHONE 415/570-5355

BMI

ALEX McEACHERN
PRESIDENT

CUSTOMER SERVICE
JOE CENNELY
JERRY BROWN

Contents

Section I: Welcome to Your PowerScope

iv Impatient User's Guide
iv Part 1 Trying it out
x Part 2 Operating Sequence
xii Part 3 Menus and Keyboard
xiv Electronic Operating Envelope
xvii Helpful Hints About Operation

Section II: Using Your PowerScope

2 Single-Phase
2 Part 1 Setup Menu
22 Part 2 Report Menu
44 Part 3 Connecting to Single-Phase

46 Dual-One Phase
46 Part 1 Setup Menu
70 Part 2 Report Menu
94 Part 3 Connecting to Dual-One Phase

98 Three-Phase Delta
98 Part 1 Setup Menu
114 Part 2 Report Menu
132 Part 3 Connecting to Three-Phase Delta

134 Three-Phase Wye
134 Part 1 Setup Menu
154 Part 2 Report Menu
178 Part 3 Connecting to Three-Phase Wye

180 DC or Custom Setups
180 Part 1 Setup Menu
224 Part 2 Report Menu
256 Part 3 Connecting to DC

258 Using Probes
258 Part 1 Setup Menu
286 Part 2 Report Menu

298 Key Operator Menu
Setting:
- 300 waveshape tolerance
- 304 hysteresis
- 306 auto or manual impulse ranging
- 308 Centigrade or Fahrenheit
- 310 UPS
- 310 clock and calendar
- 318 naming and protecting memory slots

320 Operation
Using:
- 320 MONITOR
- 322 STATUS
- 322 LOCK
- 324 SELF-CALIBRATION
- 324 SELF-TEST
- 326 CANCEL PRINTER
- 326 STORE MEMORY
- 328 RECALL MEMORY

330 Loading Paper

334 Troubleshooting

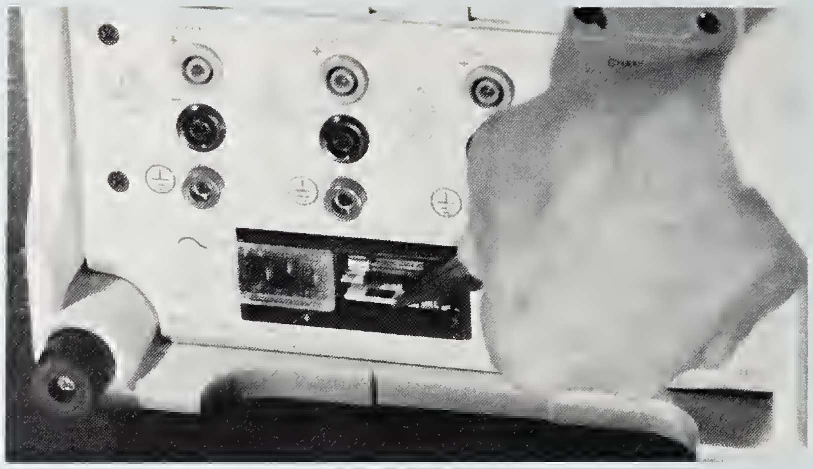
338 Specifications and Technical Description

Appendices

A-1 A Setup Menu Questions
B-1 B Report Menu Questions
C-1 C Key Operator Menu Questions
D-1 D Quick Connection Guide
E-1 E Graphs
F-1 F Recommended Thresholds
G-1 G Operating the Modem

i-1 Index

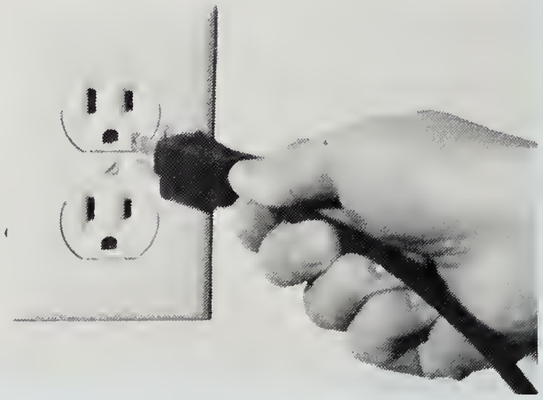
1. Check the supply voltage on the back panel of the PowerScope.



The supply voltage is set with a small PC card positioned under the fuse holder on the back of the instrument. Check that the PC card is positioned so that you can read your supply voltage when the card is inserted into the PowerScope. If the setting doesn't match your supply voltage, use a needle-nose pliers to gently pull the PC card out and reinsert it so that the supply voltage is visible.

Supply Voltage Setting	Guaranteed Operation
120 VAC	80-140 Vrms, 50/60 Hz
240 VAC	160-280 Vrms, 50/60 Hz

2. Plug your PowerScope in.

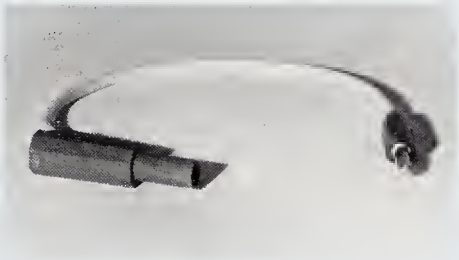


Find the power cord in the shipping container and plug your PowerScope into a wall outlet. As soon as you do this, the display will light up with “Idle” or “Monitor”.

3. **Connect your PowerScope for monitoring single-phase power.** Find these monitoring cables in the shipping container:

- one blue jumper cable

- one yellow ground cable with green ground plug



- one measuring cable with black, red, and green connections on one end, and a wall plug on the other.

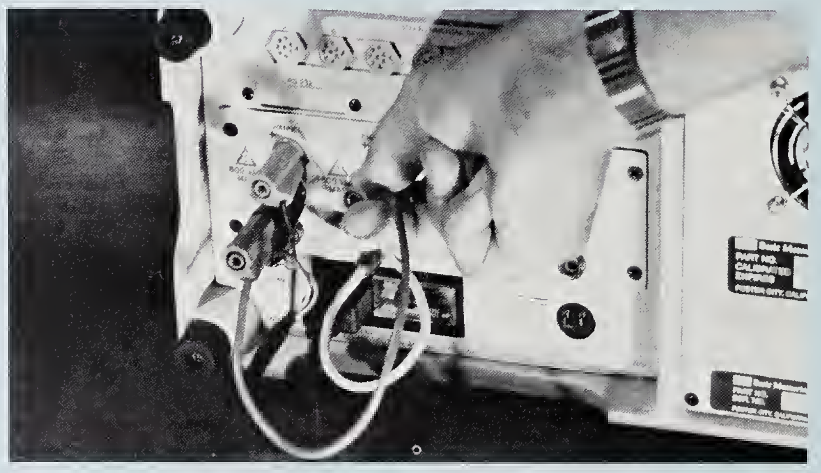
A. Using the measuring cable, plug the green connector into the Channel 1 green (ground) socket, and plug the red connector into Channel 1 red (positive) socket.

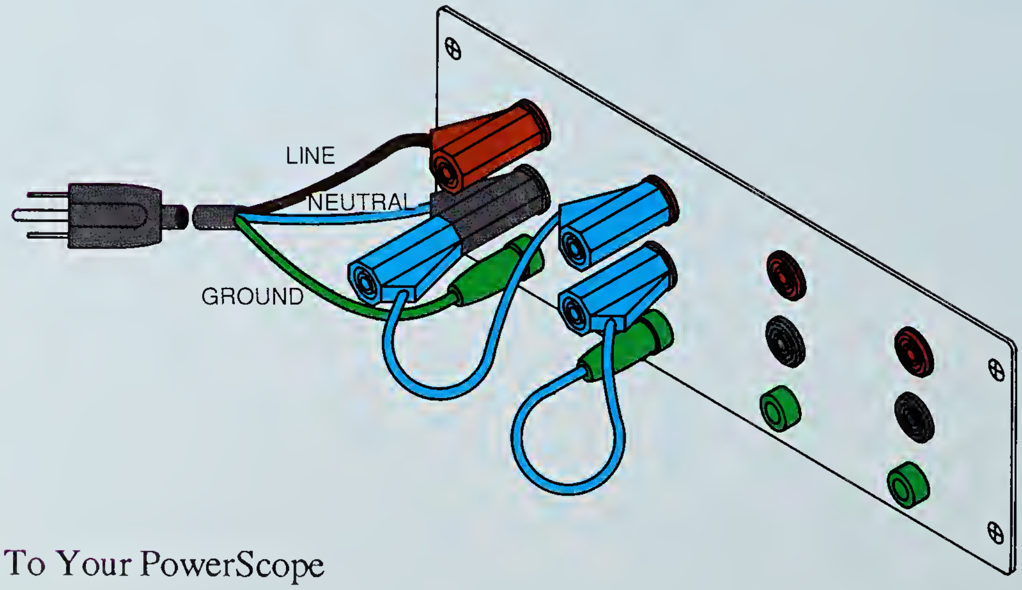
B. Plug the black connector of the measuring cable first into a blue jumper cable, then into the Channel 1 black (negative) socket. Plug the other end of the blue jumper into the Channel 2 red (positive) socket.

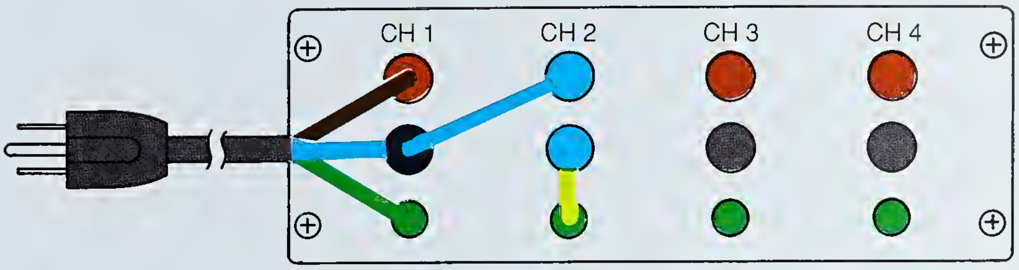
C. Plug one end of the yellow ground cable into the Channel 2 green (ground) socket, and the other end into Channel 2 black (positive) socket.

D. Last, plug the three-prong plug of the measuring cable into a wall socket.

WARNING
You are working with high voltages that cause burns and lethal shocks. Connect the safety earth ground first. USE STANDARD SAFETY PRECAUTIONS.





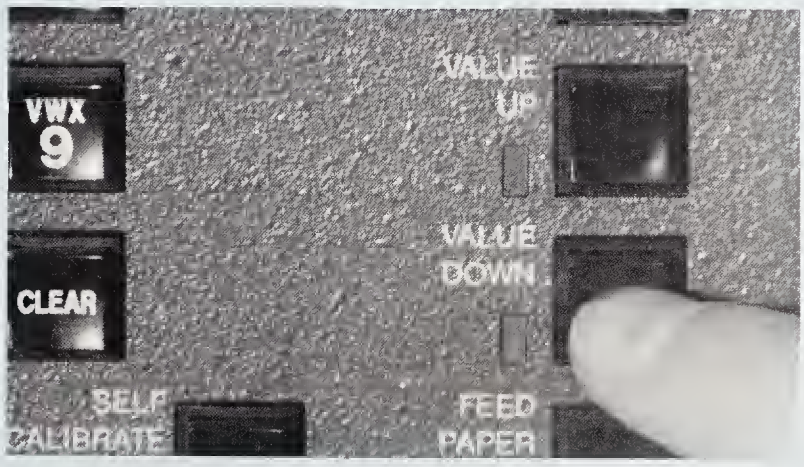


4. Press the RECALL MEMORY key.

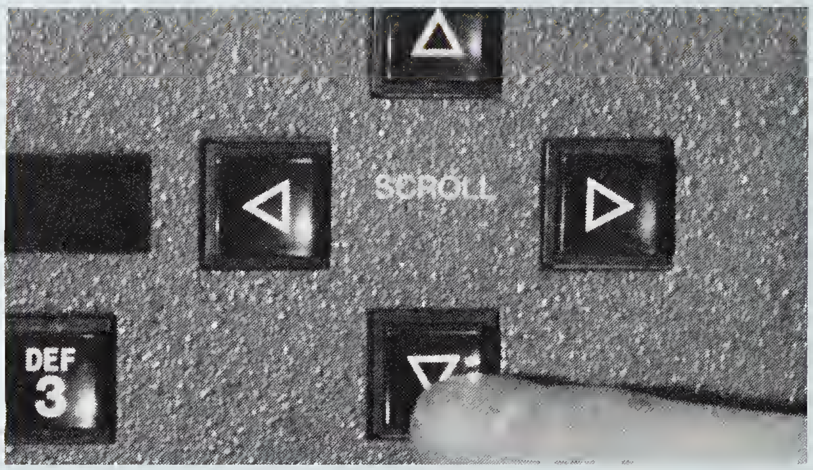
NOTE: If "Summary rpts: Print" appears in the display, it's because the PowerScope has strip charts to print from a previous monitoring session. Use the VALUE UP/VALUE DOWN keys to position CLEAR in the display, press the down arrow, and proceed.

5. Use the VALUE UP/VALUE DOWN keys to position DEFAULT in the display.

DEFAULT restores reasonable threshold settings for monitoring 120 V, 60 Hz single-phase power.

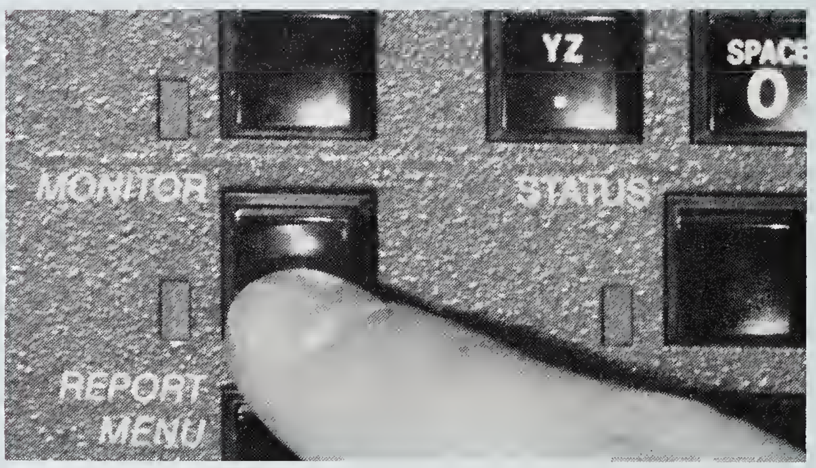


6. Press the down arrow.



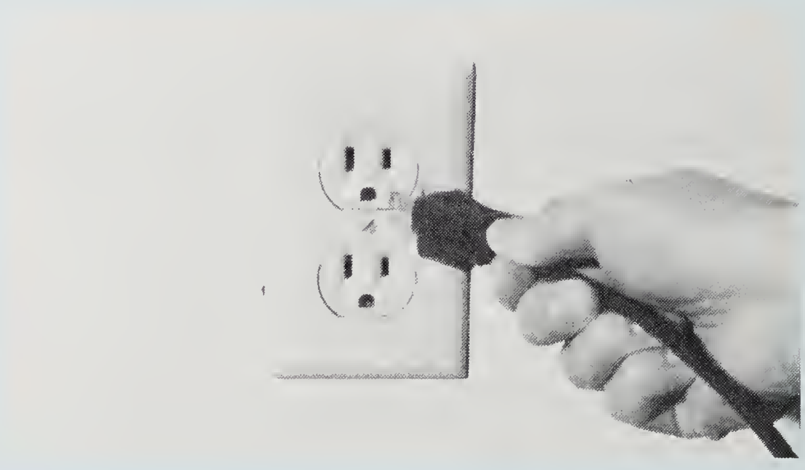
7. Press the MONITOR key.

Immediately a Threshold Report will be printed showing the current settings, then an Initial Waveshape Report will be printed showing the electrical sine waves.



8. Now, unplug the measuring cable to create a disturbance.

Your PowerScope will automatically report the disturbance with waveshape faults, sags, and/or surges, and impulses if they occurred. Monitoring with the PowerScope is that easy!

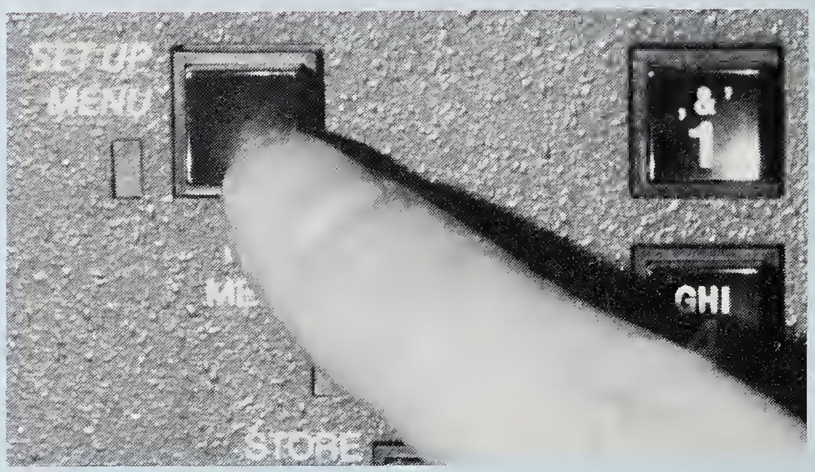


If you have any questions at all, please call a BMI Customer Service Engineer at 415/570-5355. We'll be glad to help you.

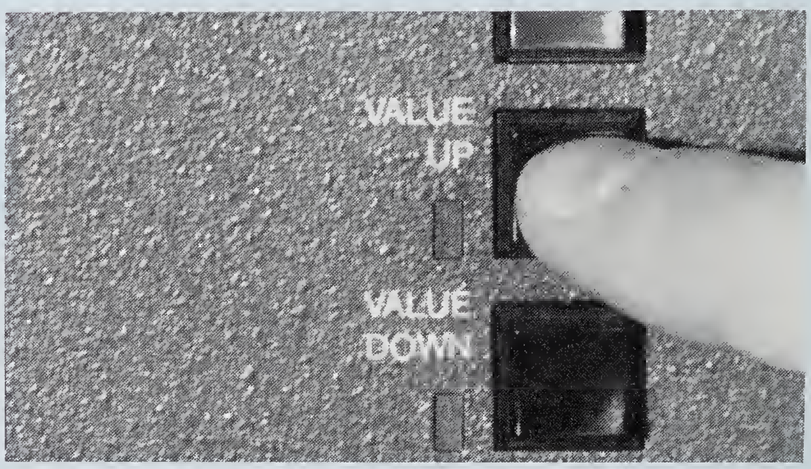
Part 2
Operating Sequence

Part 2 of the Impatient User's Guide explains the usual sequence for operating the PowerScope.

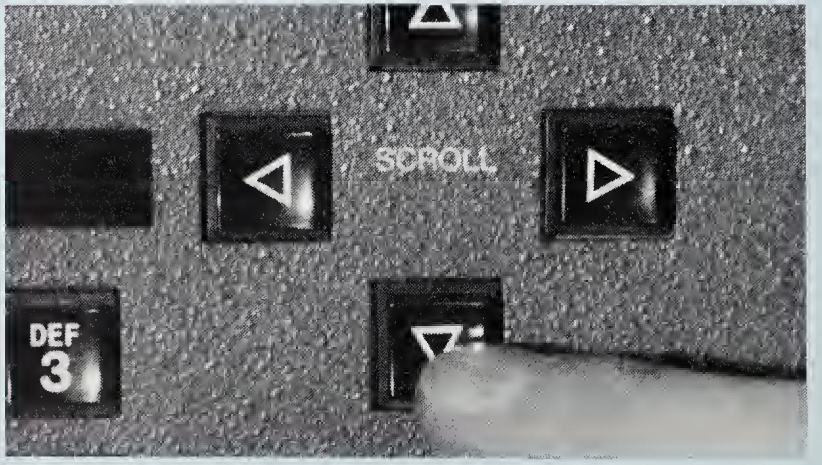
1. Press the SETUP MENU key.



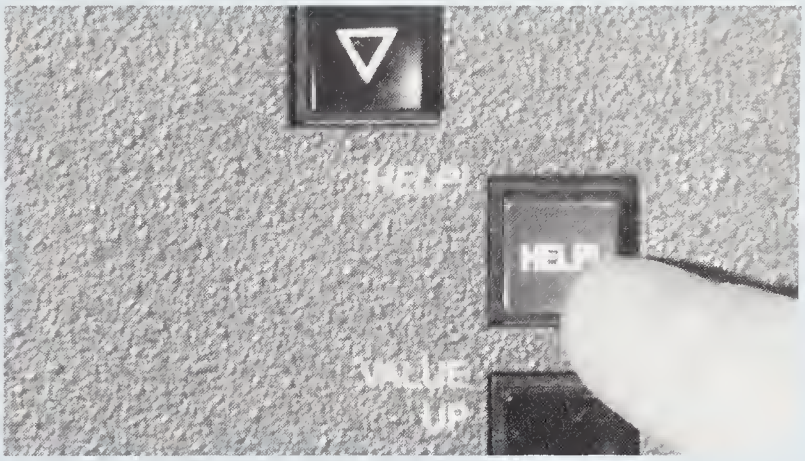
2. Use the VALUE UP/VALUE DOWN keys to scroll through the choices for each question in the menu.



3. Press the down arrow to go to the next question.



4. Press the HELP! key at any time for a printed explanation of what the question means or what to do next.



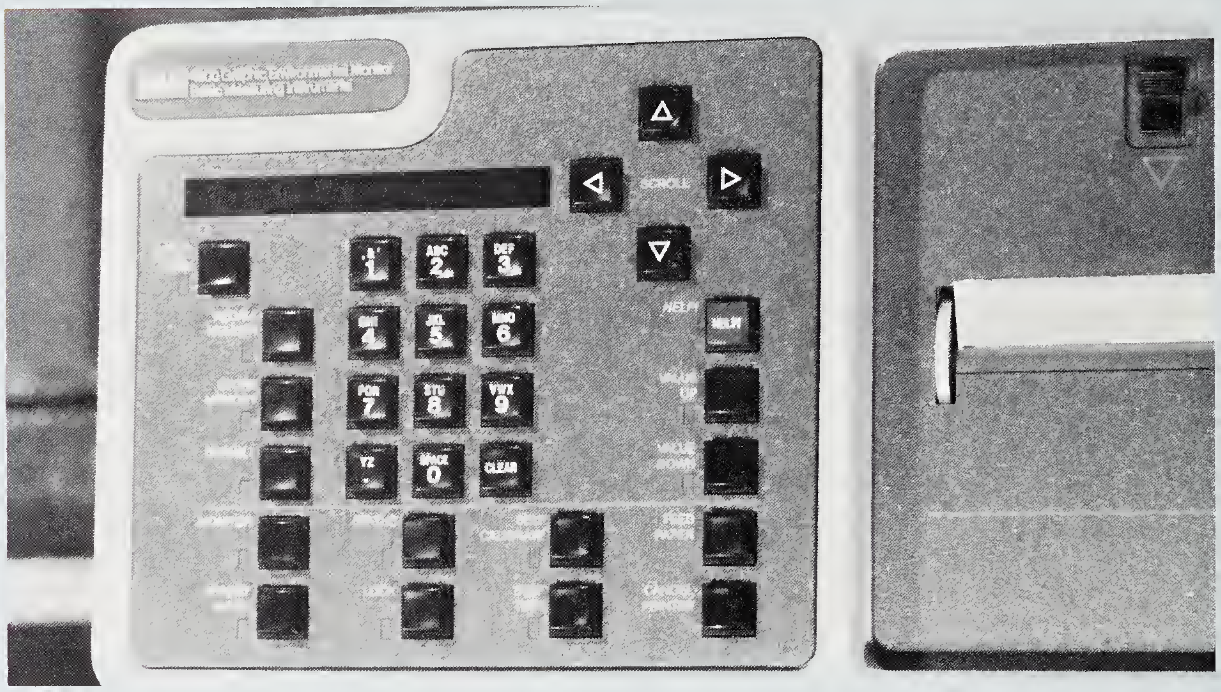
5. Connect the PowerScope to the power line. When you get to the question called "TYPE:" in the Setup Menu, press the HELP! key for a quick explanation on how to connect the PowerScope, or see the following pages:

Connecting to single-phase	page 44
Connecting to dual-phase	page 94
Connecting to three-phase delta	page 132
Connecting to three-phase wye	page 178

6. Press the MONITOR key. Disturbance graphs will be printed automaticaly.

7. Press the CANCEL PRINTER key, then the up arrow to reset the PowerScope.

Part 3 Menus and Keyboard



SETUP MENU	Accesses Setup Menu (Setup Menu then up arrow = Key Operator Menu)
RECALL MEMORY	Reads stored settings into on-line memory.
STORE MEMORY	Writes on-line memory into storage.
DEFAULT	Enters reasonable limits for some thresholds.
MONITOR	Prints current threshold settings and starts monitoring the power line.
REPORT MENU	Accesses Report Menu, which turns specific graphs and reports on or off. (Monitor then up arrow = immediate monitoring)
STATUS	Samples power line and provides a text report for the voltage, high-frequency noise at monitor's input terminals, and internal battery condition.
LOCK	Locks keyboard.
SELF CALIBRATE	Calibrates instrument, using internal voltage standard.
SELF TEST	Provides printout of current software version installed, initiates instrument self-diagnosis, and prints report.
SCROLL arrows	Moves cursor in display, scrolls through questions in menus.
HELP!	Provides printout on how to proceed.
VALUE UP/VALUE DOWN	Scrolls up and down through possible choices for one parameter.
FEED PAPER	Causes paper to advance.
CANCEL PRINTER	Cancels printer action instantaneously. (Cancel printer then up arrow = reset)
Numerical/Letter keypad	Used for making control settings.
CLEAR	Clears an entry.

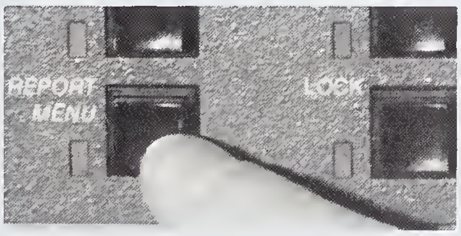
Three menus control the data you receive from the PowerScope:

1. Use the Setup Menu to adjust the limits that define a power disturbance.

(Press the SETUP MENU key.)

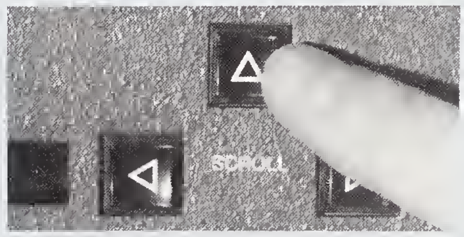
2. Use the Report Menu to specify the disturbance graphs, strip charts, and summary reports you want printed.

(Press the REPORT MENU key.)



3. Use the Key Operator Menu to control administrative detail such as the setting of the clock and calendar, whether temperature should be reported in Centigrade or Fahrenheit, etc.

(Press the SETUP MENU key, then the up arrow.)

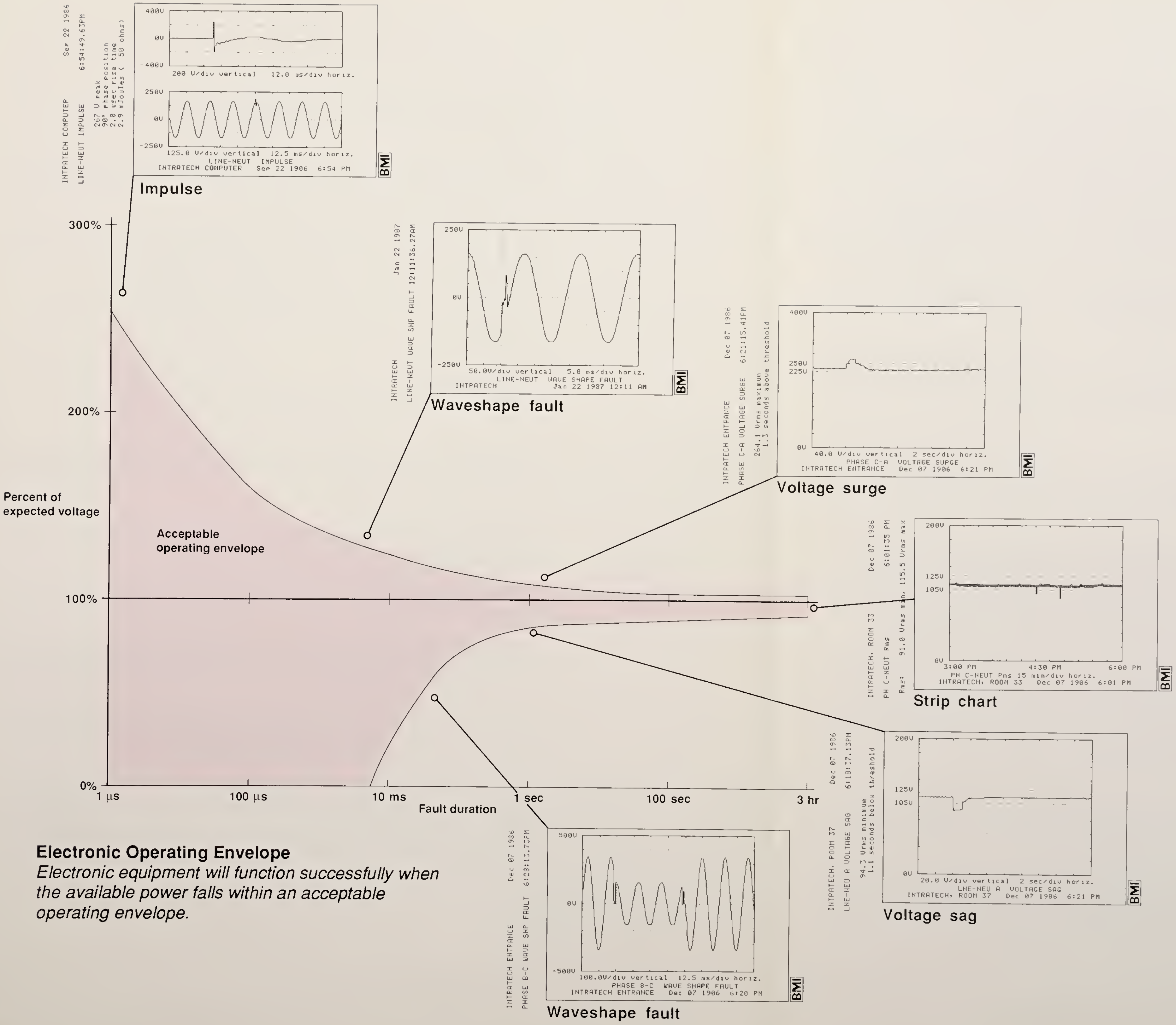


Electronic Operating Envelope

Electronic equipment will function successfully when the available power falls within a defined operating envelope. As illustrated by the graph at right, the amplitude and duration of disturbances are the characteristics that determine if power falls outside of the envelope.

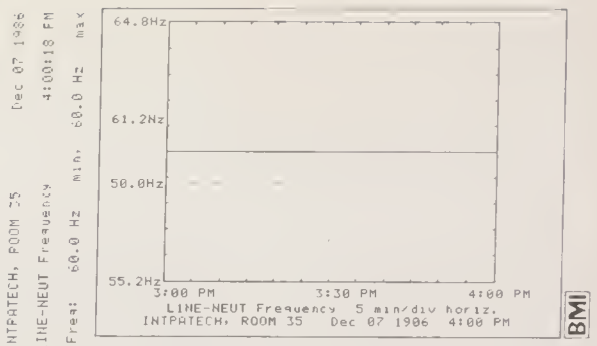
To formulate a complete diagnosis of power quality, a power monitor must detect all disruptive disturbances. These include impulses, waveshape faults, and voltage sags and surges, but in addition, frequency errors, high-frequency noise, radio-frequency interference, and temperature and humidity fluctuations should be considered as possible causes of operating problems.

When these disturbances are graphed, they can be analyzed, traced to their source, and solved.

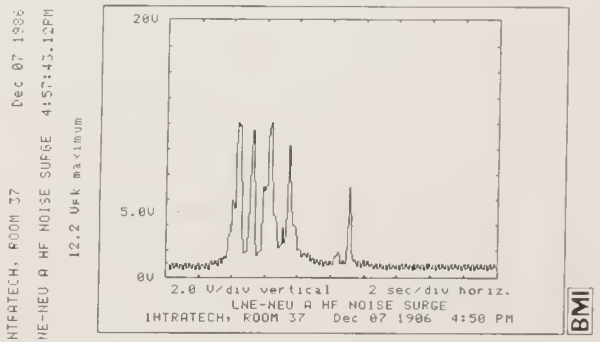


Electronic Operating Envelope

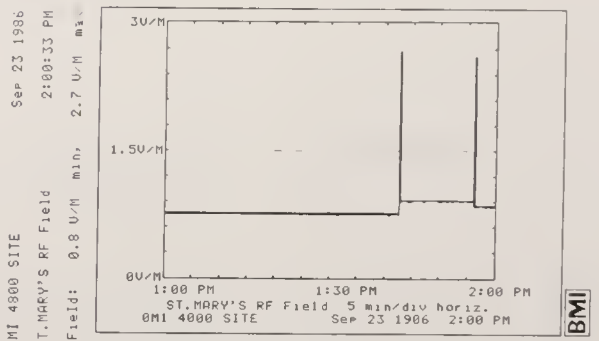
Electronic equipment will function successfully when the available power falls within an acceptable operating envelope.



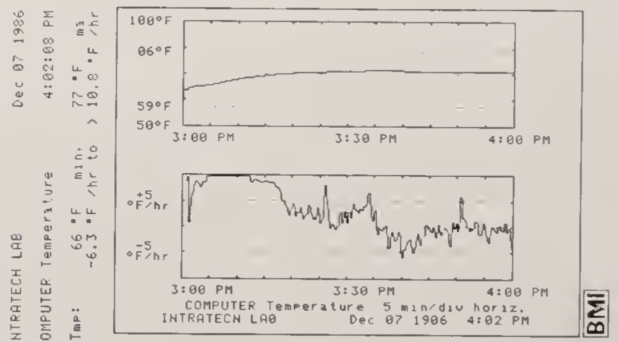
Frequency



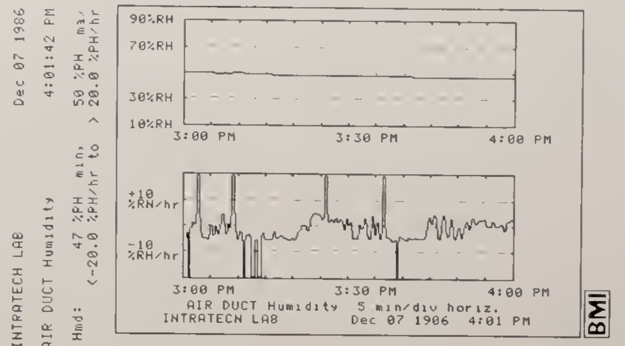
High-frequency noise



Radio-frequency interference



Temperature



Humidity

Helpful Hints About Operation

For the beginner

- Use the HELP! button when you get stuck.
- To get started, press the SETUP MENU key. Use the up arrow and down arrow keys to work through the menu.
- When you reach the third question in the Setup Menu, "Type:" (power type), press the HELP! key for a quick explanation of how to connect the PowerScope for monitoring the type of power you choose.
- To set the clock and the calendar, use the Key Operator Menu. To get the Key Operator Menu, press the SETUP MENU key, then immediately press the up arrow key.
- To unlock the keyboard, press the LOCK key, then the CLEAR key.
- To re-set the PowerScope, press the CANCEL PRINTER key, then immediately press the up arrow key.

For the advanced user

- Pressing the MONITOR key then immediately pressing the up arrow key starts the PowerScope monitoring without printing threshold reports and initial waveshapes.
- If you're trying to choose reasonable thresholds to characterize an unknown site, try this: 1) Set fairly tight thresholds; then, using the Report Menu, set the strip chart interval to 24 hours, turn off all the disturbance graphs, but leave all the strip charts on. 2) Monitor for 24 to 48 hours. 3) Use the resulting strip charts to select reasonable thresholds for the site, then turn the disturbance graphs back on.
- If you're trying to get an extremely precise picture of an unknown impulse: use the blue jumper cables to connect all four channels in parallel; use the Key Operator Menu to select manual impulse ranging; select independent channels as your power type; then set each channel with a different impulse threshold and impulse full-scale range. You'll see the same impulse presented in a variety of ways.

Checking out a new computer site

- If possible, monitor the site before installing the computer. This will allow you to distinguish between presite problems and problems generated after the computer was installed.
- Monitor power at the junction box or circuit breaker panel closest to where the computer will be installed. Monitor temperature and humidity with an A-003 probe placed on the floor where the computer will stand (most computer systems draw air from their base).
- Leave the monitor installed for at least one complete business cycle (typically a week).
- Set the PowerScope thresholds to match the requirements of the computer you're going to install. If there isn't any data available on its requirements, start with the thresholds in Appendix F (page F-1).
- Press the STATUS key as soon as you've installed your PowerScope. You will find out if you've installed it correectly, and you may find gross problems immediately (high neutral-to-ground voltages, wiring errors, etc.).
- In this application, you'll usually use the Report Menu to turn off all the disturbance graphs, and just use the strip charts to decide if the site meets your requirements.
- After you complete your site survey, file the strip charts away. They may be extremely valuable in the future to help identify what's changed after the computer has been installed.
- To ensure the new computer system isn't disrupting the power and the environment, it's good practice to continue monitoring for one business cycle after the computer is installed.

Tracking down an intermittent computer problem

- Eliminate, if possible, the most likely causes of intermittent failures: operator errors, software bugs, and loose cables and connections.
- Connect your PowerScope as close as possible to the power source for the equipment that's failing.
- Set your thresholds somewhat tighter than the acceptable power specifications of the equipment. If you lack data on the acceptable power specifications, consult Appendix F (page F-1).
- You may want to use the Report Menu to turn off the disturbance graphs, set the strip chart interval to 1 hour, and monitor for a couple of hours. This will tell you if the power is reasonable, or if it is clearly out of spec.
- If the power looks reasonable, use the Report Menu to turn the disturbance graphs back on, and reset the strip chart interval to 24 hours. Monitor for one business cycle (typically 7 days), and check to see if there is a correlation between the equipment's failure log and the recorded power disturbances.

Checking the effectiveness of a power conditioner

◦ If it's a single-phase power conditioner, you can monitor both the input and output of the power conditioner simultaneously with a standard PowerScope (see Chapter 2, page 46). For three-phase power condtioners, you have three choices:

1) Monitor two of the phases on the input simultaneously with two of the phases on the output (see Chapter 5, Independent Channels, on page 180).
2) Monitor all the input phases first, then monitor all of the output phases (see Chapter 3, page 98, for three-phase delta, or Chapter 4, page 134, for three-phase wye).
3) Use three or four A-111 AC/DC/Impulse probes to record the input power, while you use the main PowerScope channels to record the output power.

◦ You'll probably set the thresholds for the output of your power conditioner somewhat tighter than the thresholds for the input. Otherwise, you'll see disturbances on the input, but won't get a recording of the attenuated disturbance on the output.

◦ Note that all safety ground connectors are bussed together inside the PowerScope, and are also connected to the safety ground of the PowerScope's power cord.

◦ For long term monitoring of power conditioning effectiveness, use the Report Menu to turn off all your disturbance graphs, and set the strip chart interval to 24 hours.

Sizing power conditioners

◦ If you have current transformers (CT's) already installed on your power lines, you can use them, with appropriate shunt resistors, to graphically record the current requirements of your computer system. Set your PowerScope to the Independent Channels power type (see Chapter 5, page 180), and use the channels to record the outputs of your current transformers. Remember to multiply the PowerScope graphs (which will be in volts) by the appropriate correction factor for your shunt resistor and CT to obtain amps.

◦ The PowerScope's input impedance is approximately 2.048 Megohms. Use an appropriate shunt resistor to obtain full-scale current readings from your CT's of approximately 10 volts.

◦ To choose the optimum size of power conditioner, be sure to measure the starting current surge of the entire system (electronics, fans, printer motors, disk drive motors, etc.), and measure the operating current as well.

Monitoring high-voltage power lines (more than 480 volts)

◦ Use standard Potential Transformers to reduce high-voltage lines to 120 Volts or 240 Volts nominal. The PowerScope's input impedance is greater than 2 Megohms, so it can be used with virtually all single-phase and three-phase PT's.

◦ Remember to adjust your threshold settings by the PT's ratio. For example, on a 12 KV·nominal line, a 100:1 PT ratio would give you 120 Volts nominal. If you set your PowerScope surge voltage threshold to 125 Vrms, the actual surge threshold is 12.5 KV.

◦ Potential Transformers may exhibit some attenuation of high-frequency disturbances (impulses and high-frequency noise).

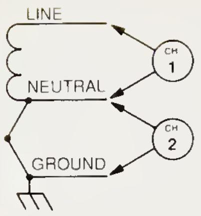
Preventive monitoring

◦ Preventive monitoring means installing a PowerScope at a site that isn't experiencing any power problems, and leaving it installed. This is typically done at large computer installations, critical control panels, telecommunication control rooms, and other critical load sites.

◦ Preventive monitoring can show a power environment that is drifting towards a problem threshold (for example, line voltage may decrease over the course of several months as more and more loads are added to a distribution line). It can also be used to detect non-disruptive power disturbances that may decrease equipment life (for example, low-level voltage impulses).

◦ Typically, for a preventive monitoring installation, you will choose thresholds considerably tighter than the acceptable power specifications of the most sensitive equipment at the site. Then use the Report Menu to set the strip chart interval to 24 hours, and turn off all disturbance graphs (but leave the strip charts on).

◦ Review and file the strip charts once each business cycle (typically once per week). If the power is deteriorating, use the Report Menu to turn the disturbance graphs on and analyze the source of the problem. Once the problem is solved, use the Report Menu to turn the disturbance graphs off again.



This chapter shows you how to set up the PowerScope for monitoring single-phase power.

Quick Guide

1. Press the SETUP MENU key.

2. Answer the questions in the menu using the VALUE UP/ VALUE DOWN keys or the number keypad.

3. Press the down arrow key to go on to the next question.

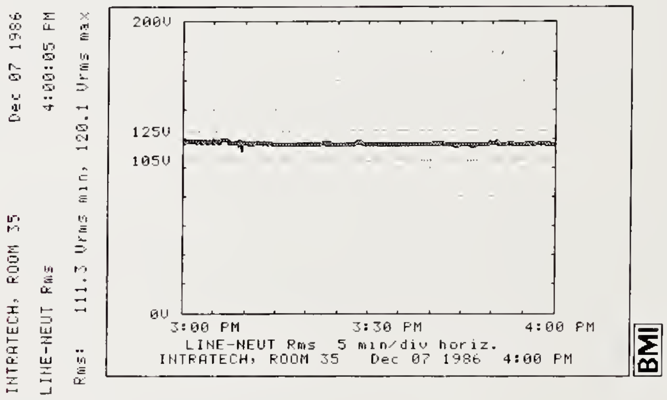
4. Press the HELP! key if you want further explanation about the question.

Press the SETUP MENU key now.

If you get the following message in the display, it's because the PowerScope has strip charts from the previous monitoring period.

Summary rpts: Print

Possible selections: Print
Clear



This is a 1-Hour summary strip chart.

Use the VALUE UP/ VALUE DOWN keys to choose whether you want the pending strip charts.

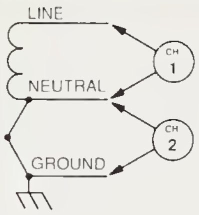
If you want them printed then erased, position PRINT in the display, then press the down arrow. If you want them erased immediately, position CLEAR in the display, then press the down arrow.

Press the SETUP MENU key and proceed.

HELP!

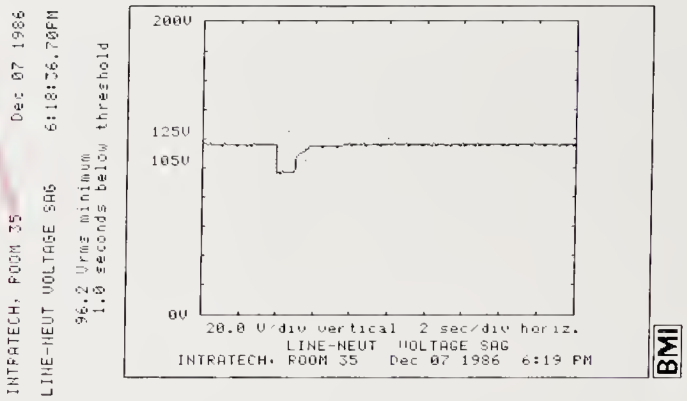
```
Use the VALUE UP/VALUE DOWN keys to
select PRINT or CLEAR and then
use the DOWN ARROW key to enter
the menu you have selected.

If you select PRINT, the summary data
and strip charts that have been
gathered so far by the PowerScope will
be printed and then reset. If you
select CLEAR, all of the summary
data and strip charts will be reset
without printing.

If you don't want to lose any summary
data, you may return to the Monitor
mode by pressing the MONITOR key.
```

Setup Menu, continued



Site: INTRATECH, ROOM

Use the number keys to enter the name of the site where you are monitoring.


INTRATECH, ROOM 35 Dec 07 1986
LINE-NEUT VOLTAGE SAG 6:18:36.70PM
96.2 Vrms minimum
1.0 seconds below threshold

20.0 V/div vertical 2 sec/div horiz.
LINE-NEUT VOLTAGE SAG
INTRATECH, ROOM 35 Dec 07 1986 6:19 PM

Use the left and right arrow keys to move the flashing cursor.

Use the number keys to enter both letters and numbers; for example, to enter the letter "K", press the 5JKL key 3 times. On the first press, a 5 will appear, on the second a J, and on the third, a K will appear.

Now move the flashing cursor to the next position by pressing the right arrow key. Press the 0 SPACE key twice to enter a space. Press the down arrow key to go on to the next question.

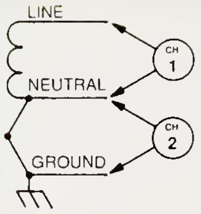
HELP!

```
You may enter up to 20 characters from
the keyboard to identify the site
that you are monitoring.

Use the left and right arrow keys to
move the flashing cursor.

Use the number keys to enter both
letters and numbers.  For example,
to enter the letter 'B',  push the
'2ABC' key three times.

(Press HELP! again for general
information on the Setup Menu.)
```

```
The Setup Menu contains questions that
define the operating parameters of
your PowerScope.   Specifically, it
asks you to name the monitoring site,
state what type of power each channel
will monitor, and specify thresholds
for each measurement.

The questions in the Setup Menu change
automatically depending on what type
of power you assign each channel and
if you have probes plugged into the
environmental channels.

(Press HELP! again for general infor-
mation on the operating sequence.)
```

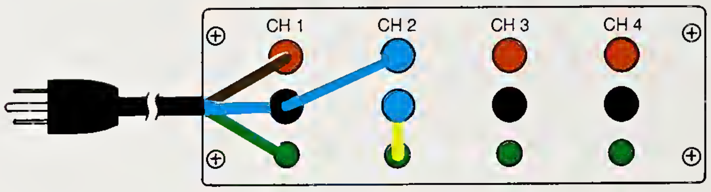
```
The usual sequence for operating
the PowerScope monitor is:

  1) Press the SETUP MENU key and
     answer the questions.
     To go on to the next question,
     press the Down Arrow.

  2) Connect the monitor to the
     power line. (See the HELP!
     message in the Setup Menu
     for the 'TYPE:' question.)

  3) Press the MONITOR key to monitor
     the power line.  Your reports
     will be printed automatically.

(Press HELP! again for general infor-
mation on the six modes of operation.)

======================================

======================================

The PowerScope monitor can be in one
of six modes:

    1) Press the SETUP MENU key to
       program the Setup Menu.
       Use the up arrow and the down
       arrow key to work your way
       through the questions on the
       menu. The 'HELP!' key will
       always give you information
       on a question on the menu.
       (You may want to press 'HELP!'
       when you have selected the type
       of power line you are going to
       monitor. This will give you
       installation instructions.)

       By pressing the SETUP MENU key,
       then immediately pressing the
       UP ARROW key, you will enter
       the Key Operator Menu.  This
       menu will give you control of
       the detailed operation of the
       PowerScope.

    2) Press the STATUS key to print
       the Status Report.  This
       report tells you the present
       voltage, frequency, and noise
       on each of the channels.  This
       report can be especially
       useful when you're trying to
       set the thresholds correctly.
       It's also useful for checking
       to see if you've installed the
       monitor correctly.

    3) Press the REPORT MENU key to
       enter the Report menu.  Use
       the up arrow and the down
       arrow to work your way through
       the questions on the menu.
       The 'HELP!' key will always
       give you information on a
       question on the menu.

    4) Press the MONITOR key to start
       monitoring the power line.
       The PowerScope will print a
       complete copy of your setup,
       and show you the initial wave-
       shapes on each channel (if you
       have requested them in the
       Report Menu).  Then it will
       print a disturbance report
       every time a power disturbance
       occurs.

    5) Press the SELF CALIBRATE key
       to calibrate your PowerScope.
       The PowerScope has the ability
       to completely calibrate itself.
       A Calibration Report will be
       printed automatically, showing
       the calibration of all of the
       ranges on all of the channels.

    6) Press the SELF TEST key to test
       the PowerScope.

(There is no more HELP!)
```

Setup Menu, continued

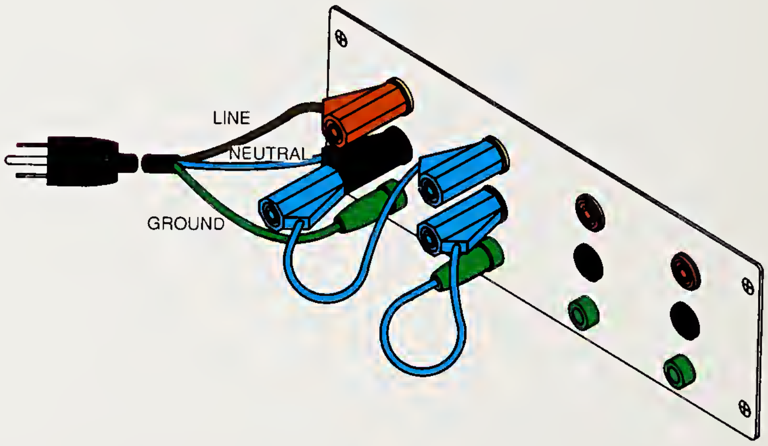


Type: Single Phase

Selections: Single Phase
Dual 1-phase
3 phase delta
3 phase wye
Ind. channels



Use the VALUE UP/ VALUE DOWN keys to select single phase power.



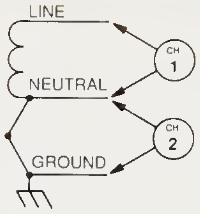
Press the HELP! key for information on connecting your PowerScope to single-phase power, or see Part 3 of this chapter on page 44.

WARNING
You are working with high voltages that cause burns and lethal shocks. Connect the safety earth ground first. USE STANDARD SAFETY PRECAUTIONS.

HELP!

```
Select '1 phase' to monitor a single
phase source.

To install the PowerScope on a single
phase line, make the following
connections:

Channel 1 GREEN terminal: SAFETY
                          GROUND

Channel 1 Red terminal:   Phase
Channel 1 Black terminal: Neutral

Channel 2 Red terminal:   Neutral
Channel 2 Black terminal: Ground

Channel 3 and Channel 4 have no
connections.

(Press HELP! again for general
information on the Setup Menu.)
```

Setup Menu, continued

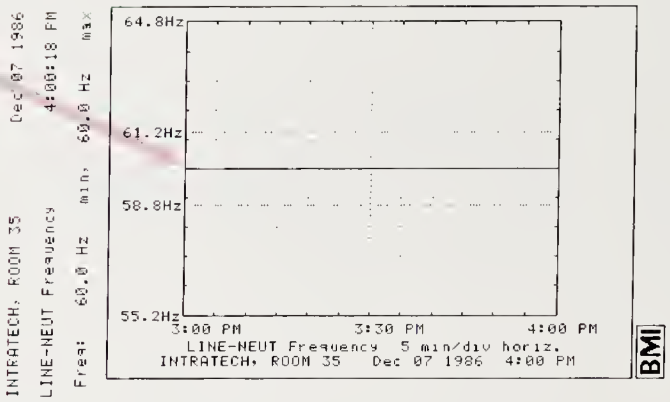


Nom. freq.: 60.0Hz

Range: 45Hz to 450Hz

Use the number keys to enter the nominal frequency of the line you are monitoring.

Typical settings are 50.0 Hz, 60.0 Hz, 400.0 Hz, or 415.0 Hz.

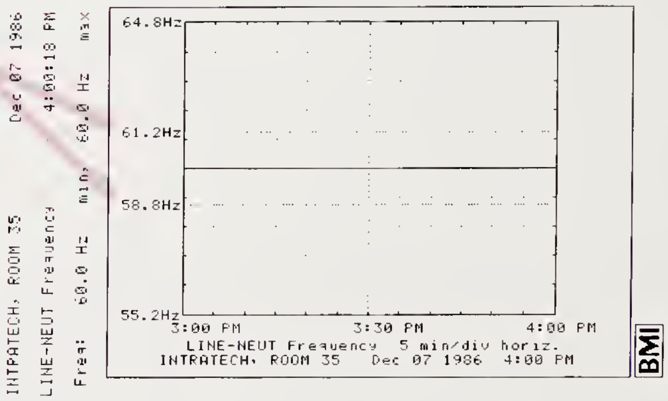


Freq. tol.: 1.2Hz

Range: 0.4Hz to 135.0Hz

Use the number keys to enter a threshold for line-frequency deviation.

The range is 1% to 30% of the nominal frequency, and is entered in Hertz. A typical value is 2% of the nominal frequency.



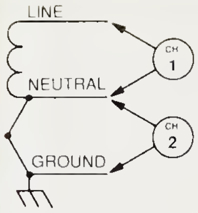
For example, if the nominal frequency setting is 50.0 Hz,
the frequency tolerance range is .5 Hz (1%) to 15.0 Hz (30%).
If the frequency is 60.0 Hz, the frequency tolerance range is 0.6 Hz to 18.0 Hz.
If the frequency is 400.0 Hz, the frequency tolerance range is 4.0 Hz to 120.0 Hz.
If the frequency is 415.0 Hz, the frequency tolerance range is 4.2 Hz to 124.5 Hz.

HELP!

```
Enter the nominal line frequency of
the line you are monitoring.  This
provides a reference to the monitor
from which it can base its measure-
ments. Typical values are 50.0 Hz,
60.0 Hz, and 400.0 Hz.  The
acceptable range is 45.0 Hz to
450.0 Hz.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

```
Enter in Hertz the amount of line
frequency deviation from nominal that
you are willing to tolerate before the
PowerScope reports a disturbance. The
range is 0.2% to 50% of your nominal
frequency setting.   A typical value
is 2% of your nominal frequency.

For example, if your nominal
frequency setting is 60 Hz., the range
is 0.1 Hz (0.2%) to 30.0 Hz (50%).
The default setting for 60 Hz is
1.2 Hz (2%).

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued

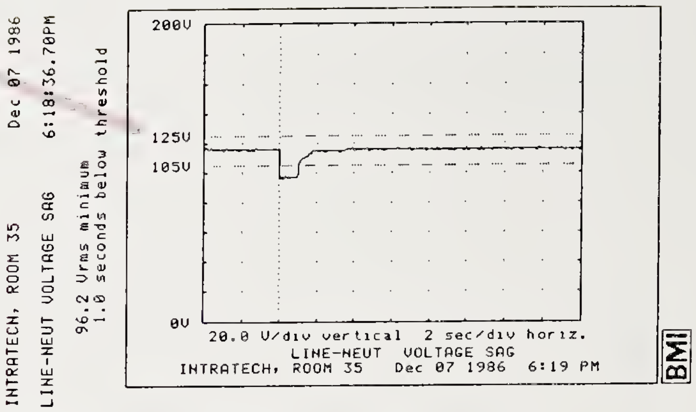


Surge volt: 125.0Vrms

Range: 1.0 Vrms to 600 Vrms

Use the number keys to enter the high-voltage threshold for line-to-neutral.

The usual value is about 10% above the nominal voltage.



This is a line-to-neutral disturbance graph.

The surge-voltage threshold also determines the full scale RMS voltage as follows:

Voltage Surge Threshold Table

Surge Threshold	Full Scale
1.0 – 6.2 Vrms	10.0 Vrms
6.3 – 12.5 Vrms	20.0 Vrms
12.6 – 25.0 Vrms	40.0 Vrms
25.1 – 62.5 Vrms	100.0 Vrms
62.6 - 125.0 Vrms	200.0 Vrms
125.1 - 166.5 Vrms	250.0 Vrms
166.6 - 250.0 Vrms	400.0 Vrms
250.1 - 600.0 Vrms	800.0 Vrms

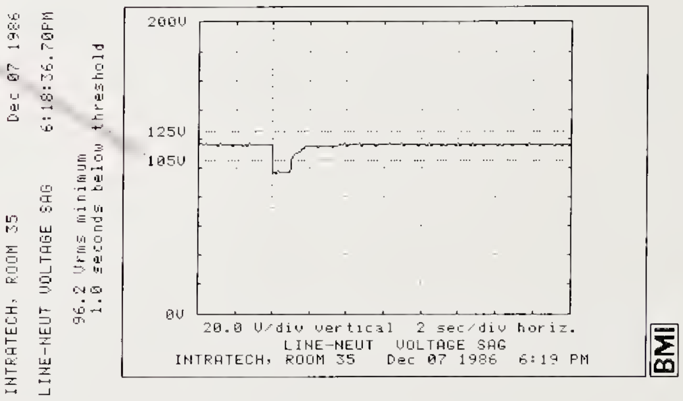
Sag volt: 105.0Vrms

Range: 0.0 Vrms to 599.0 Vrms

Use the number keys to enter the low voltage threshold for line-to-neutral.

The usual value is about 15% below the nominal voltage.

The acceptable range is 0.0 to 599.0 Vrms.



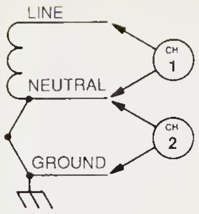
This is a line-to-neutral disturbance graph.

HELP!

```
Use the number keys to enter the
high voltage threshold.  The usual
value is about 10% above the nominal
voltage.  The acceptable range is
1.0 Vrms to 600.0 Vrms.

(Press HELP! again for general
information on the Setup Menu.)
```

```
Use the number keys to enter the low
voltage threshold.  The usual value is
about 15% below the nominal voltage.
The acceptable range is 0.0 Vrms to
599.9 Vrms.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued

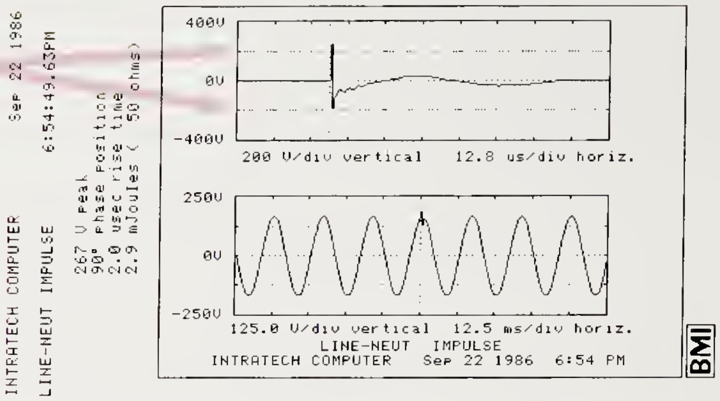


Impulse thr: 200Vpk

Range: 20 Vpk to 6000 Vpk

Use the number keys to enter the value of the smallest impulse you wish the PowerScope to report.

Typical thresholds are in the range of 100-250 volts. You may select any value from 20 Vpk to 6000 Vpk.

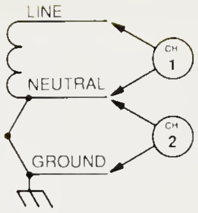


This is a line-to-neutral impulse disturbance graph.

HELP!

```
Use the number keys to enter the value
of the smallest impulse you wish the
PowerScope to report. Typical
thresholds are in the range of
100-250 volts.  You may select any
value from 20 to 6000 volts.

(Press HELP! again for more infor-
mation on answering this question.)
```

```
If you choose AUTO impulse ranging in
the Key Operator Menu, the PowerScope
will choose a full scale impulse range
according to the following table:

       Impulse              Impulse
      threshold            full scale
  -------------------      ----------
    20 Vpk -    50 Vpk        100 Vpk
    51 Vpk -   100 Vpk        200 Vpk
   101 Vpk -   200 Vpk        400 Vpk
   201 Vpk -   400 Vpk        800 Vpk
   401 Vpk -   800 Vpk       1600 Vpk
   801 Vpk -  1600 Vpk       3200 Vpk
  1601 Vpk -  6000 Vpk       6400 Vpk

However, if you choose MANUAL impulse
ranging in the Key Operator Menu, you
will be asked to select a full scale
range yourself.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```



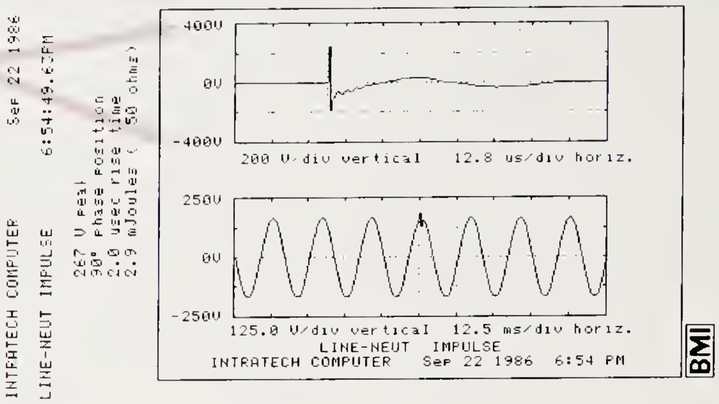
Setup Menu, continued

NOTE: The next question will only appear if you have Impulse Ranging in the Key Operator Menu set to MANUAL.

Imp. range: 400Vpk

Possible selections: See the following table.

Use the VALUE UP/ VALUE DOWN keys to select the full-scale impulse range for line-to-neutral.



This is a line-to-neutral impulse disturbance graph.

The selections depend on the impulse threshold, e.g. for a 20 - 24 Vpk threshold, there are 2 full-scale ranges available, 100 or 200 volts full-scale.

Manual Impulse Ranging Table

Impulse Threshold	Available Full-Scale Ranges
20-24 Vpk	+/- 100 or 200 volts full-scale
24-49 Vpk	+/- 100, 200 or 400 volts full-scale
50 Vpk	+/- 100, 200, 400 or 800 volts full-scale
51-99 Vpk	+/- 200, 400 or 800 volts full-scale
100 Vpk	+/- 200, 400, 800 or 1600 volts full-scale
101-199 Vpk	+/- 400, 800 or 1600 volts full-scale
200 Vpk	+/- 400, 800, 1600 or 3200 volts full-scale
201-399 Vpk	+/- 800, 1600 or 3200 volts full-scale
400 Vpk	+/- 800, 1600, 3200 or 6400 volts full-scale
401-800 Vpk	+/- 1600, 3200 or 6400 volts full-scale

If you selected AUTO Impulse Ranging in the Key Operator Menu (or plan to), the full-scale impulse range will be selected for you as follows:

Automatic Impulse Ranging Table

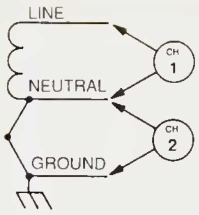
If Impulse Threshold selected in previous question is between...	The Impulse Range will set automatically to...
20 - 50 volts	+/- 100 volts
51 - 100 volts	+/- 200 volts
101 - 200 volts	+/- 400 volts
201 - 400 volts	+/- 800 volts
401 - 800 volts	+/- 1600 volts
801 - 1600 volts	+/- 3200 volts
1601- 6000 volts	+/- 6400 volts

HELP!

```
Use the VALUE UP/VALUE DOWN keys
to select the full scale impulse
range.  (If you want the PowerScope to
choose a range for you automatically,
use the Key Operator menu to select
AUTO impulse ranging.  The PowerScope
will automatically select a range that
will give you a good compromise
between resolution and dynamic range.)

(Press HELP! for more information on
selecting full scale ranges.)
```

```
The full scale impulse ranges are:

 100 Vpk
 200 Vpk
 400 Vpk
 800 Vpk
1600 Vpk
3200 Vpk
6400 Vpk

To preserve resolution, the
PowerScope will not allow you to
select a full scale range that is
less than two times your impulse
threshold or greater than 16 times
your impulse threshold:

Full scale      Acceptable thresholds
----------      ----------------------
  100 Vpk          20 Vpk -    50 Vpk
  200 Vpk          20 Vpk -   100 Vpk
  400 Vpk          20 Vpk -   200 Vpk
  800 Vpk          50 Vpk -   400 Vpk
 1600 Vpk         100 Vpk -   800 Vpk
 3200 Vpk         200 Vpk -  1600 Vpk
 6400 Vpk         400 Vpk -  6000 Vpk

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued

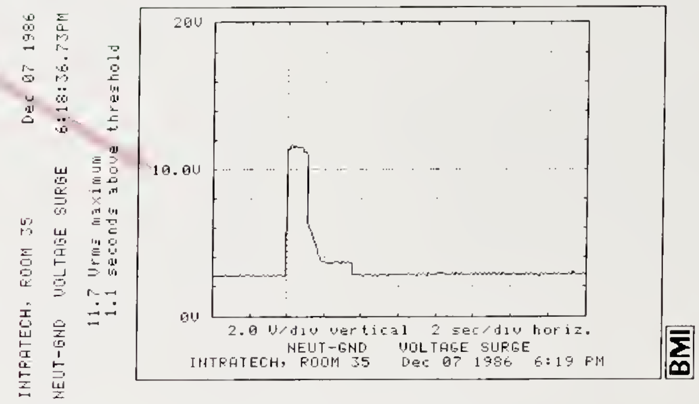


Neut-Gnd: 10.0 Vrms

Range: 0.1 Vrms to 99.9 Vrms

Use the number keys to enter the surge voltage threshold for neutral-to-ground.

You may select any value from 0.1 Vrms to 99.9 Vrms. (Typical thresholds range between 1.0 and 10.0 Vrms.)



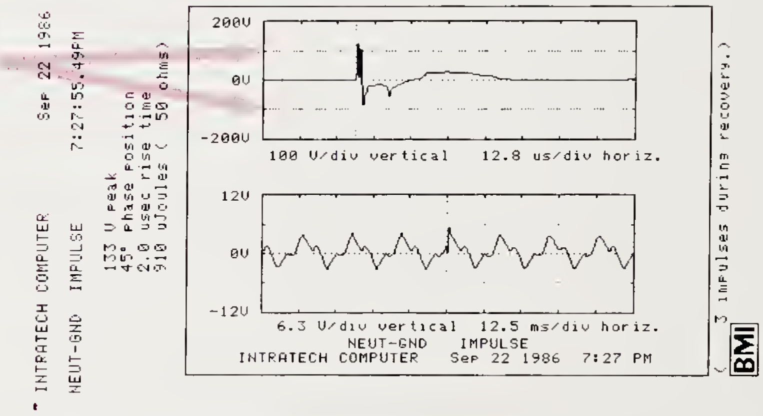
This is a neutral-to-ground surge graph.

N-G imp thr: 100Vpk

Range: 20 Vpk to 6000 Vpk

Use the number keys to enter the value of the smallest neutral-to-ground impulse you want the PowerScope to graph.

Typical thresholds range between 50-250 volts. You may select any value from 20 volts to 6000 volts.



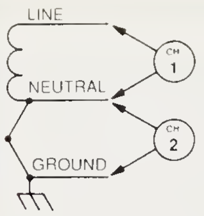
This is a neutral-to-ground impulse graph.

HELP!

```
Use the number keys to enter the
acceptable ac voltage difference
between the neutral and ground lines
being monitored by the PowerScope.
Typical thresholds are in the range
of 1.0-10.0 Vrms.  You may select any
value from 0.1 Vrms to 99.9 Vrms.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

```
Use the number keys to enter the
value of the smallest neutral-ground
impulse you wish the PowerScope to
report. Typical thresholds are in the
range of 50-250 volts.  You may
select any value from 20 to 6000
volts.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued

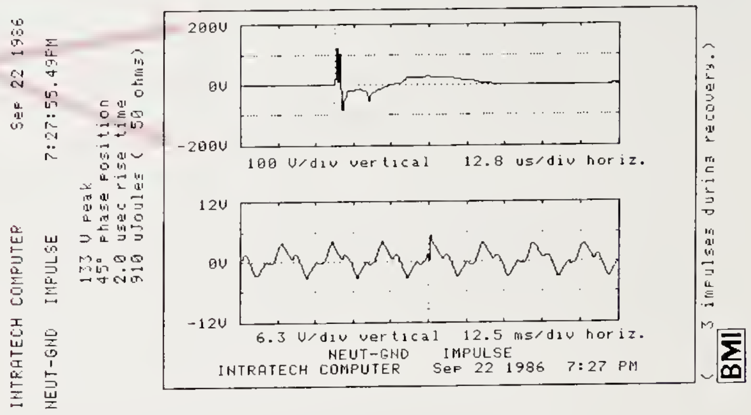


NOTE: You'll only get the next question if you have Impulse Ranging in the Key Operator Menu set to MANUAL.

N-G imp. range: 200Vpk

Possible selections: See the following table.

Use the VALUE UP/ VALUE DOWN keys to select the full-scale impulse range for neutral-to-ground.



This is a neutral-to-ground impulse graph.

The selections depend on the impulse threshold, e.g. for a 20-24 Vpk threshold, there are 2 full-scale ranges available, 100 or 200 volts full-scale.

Manual Impulse Ranging Table

Impulse Threshold	Available Full-Scale Ranges
20-24 Vpk	+/- 100 or 200 volts full-scale
24-49 Vpk	+/- 100, 200 or 400 volts full-scale
50 Vpk	+/- 100, 200, 400 or 800 volts full-scale
51-99 Vpk	+/- 200, 400 or 800 volts full-scale
100 Vpk	+/- 200, 400, 800 or 1600 volts full-scale
101-199 Vpk	+/- 400, 800 or 1600 volts full-scale
200 Vpk	+/- 400, 800, 1600 or 3200 volts full-scale
201-399 Vpk	+/- 800, 1600 or 3200 volts full-scale
400 Vpk	+/- 800, 1600, 3200 or 6400 volts full-scale
401-800 Vpk	+/- 1600, 3200 or 6400 volts full-scale

If you selected AUTO Impulse Ranging in the Key Operator Menu (or plan to) the full-scale impulse range will be selected for you according to the Automatic Impulse Table shown below:

Automatic Impulse Ranging Table

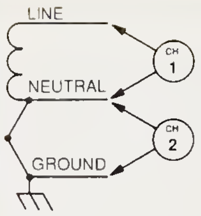
If Impulse Threshold selected in previous question is between...	The Impulse Range will set automatically to...
20 - 50 volts	+/- 100 volts
51 - 100 volts	+/- 200 volts
101 - 200 volts	+/- 400 volts
201 - 400 volts	+/- 800 volts
401 - 800 volts	+/- 1600 volts
801 - 1600 volts	+/- 3200 volts
1601- 6000 volts	+/- 6400 volts

HELP!

```
Use the VALUE UP/VALUE DOWN keys
to select the full scale impulse
range.  (If you want the PowerScope to
choose a range for you automatically,
use the Key Operator menu to select
AUTO impulse ranging.  The PowerScope
will automatically select a range that
will give you a good compromise
between resolution and dynamic range.)

(Press HELP! for more information on
selecting full scale ranges.)
```

```
The full scale impulse ranges are:

 100 Vpk
 200 Vpk
 400 Vpk
 800 Vpk
1600 Vpk
3200 Vpk
6400 Vpk

To preserve resolution, the
PowerScope will not allow you to
select a full scale range that is
less than two times your impulse
threshold or greater than 16 times
your impulse threshold:

Full scale      Acceptable thresholds
----------      ---------------------
  100 Vpk           20 Vpk -    50 Vpk
  200 Vpk           20 Vpk -   100 Vpk
  400 Vpk           20 Vpk -   200 Vpk
  800 Vpk           50 Vpk -   400 Vpk
 1600 Vpk          100 Vpk -   800 Vpk
 3200 Vpk          200 Vpk -  1600 Vpk
 6400 Vpk          400 Vpk -  6000 Vpk

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

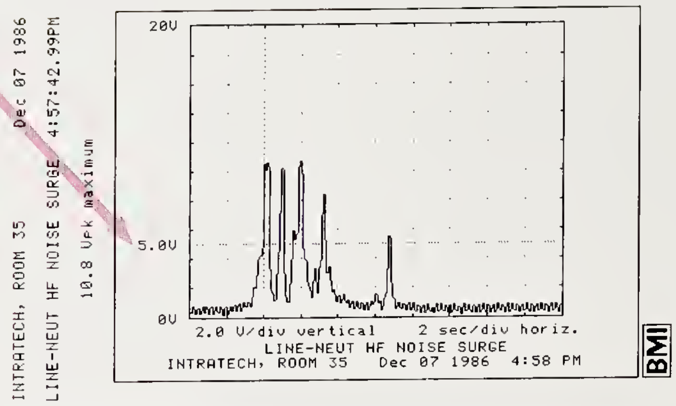
Setup Menu, continued



Hi. freq. noise: 5.0V

Range: 1.0 V to 19.9 V

Use the number keys to enter the high-frequency noise disturbance threshold (measured in peak-to-peak volts).



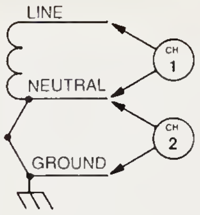
This is a high-frequency noise disturbance graph.

This threshold will be used for line-to-neutral and neutral-to-ground. A typical threshold is 5.0 Vpk. The acceptable range is 1.0 Vpk to 19.9 Vpk.

NOTE: If you are using probes for environmental monitoring there will be additional questions. See Chapter 6 (page 258) for an explanation of environmental thresholds.

HELP!

```
Use the number keys to enter the
high frequency noise disturbance
threshold (measured in peak-to-peak
volts).  A typical threshold is
5.0 Vpk.  The acceptable range is
1.0 Vpk to 19.9 Vpk.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```



The Report Menu lets you choose the graphs and strip charts your PowerScope prints. For a complete discussion of graphs and summary reports, see Appendix E.

Quick Guide

1. **Press the REPORT MENU key.**

2. **Use the VALUE UP/VALUE DOWN keys to answer the questions in the menu.**

3. **Press the down arrow to go to the next question.**

4. **Press the HELP! key if you want further explanation about the questions.**

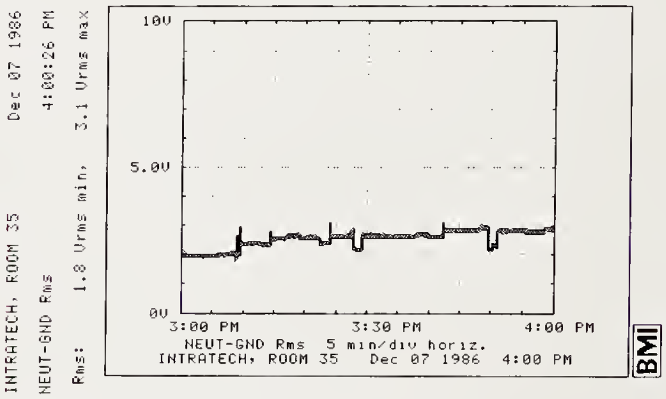
Press the REPORT MENU key now.

If you get the following message in the display, it's because the PowerScope has strip charts from the previous monitoring period.

Summary rpts: Print

Possible selections: Print
Clear

Use the VALUE UP/ VALUE DOWN keys to choose whether you want the pending strip charts.



This is a 1-Hour Summary Strip Chart.

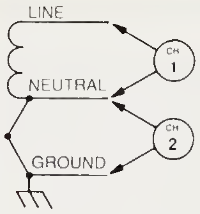
If you want them printed then erased, position PRINT in the display, then press the down arrow. If you want them erased immediately, position CLEAR in the display, then press the down arrow.

Then press the REPORT MENU key again and proceed.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select PRINT or CLEAR and then
use the DOWN ARROW key to enter
the menu you have selected.

If you select PRINT, the summary data
and strip charts that have been
gathered so far by the PowerScope will
be printed and then reset. If you
select CLEAR, all of the summary
data and strip charts will be reset
without printing.

If you don't want to lose any summary
data, you may return to the Monitor
mode by pressing the MONITOR key.
```

Report Menu, continued

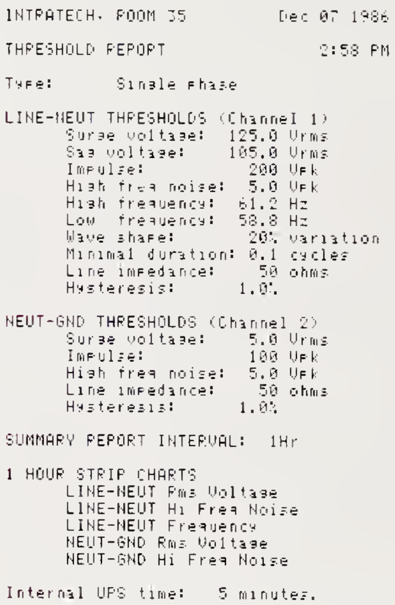


Threshold report: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn the Threshold Report on or off.

Your PowerScope prints the Threshold Report after you press the MONITOR key. The Threshold Report shows all the current settings. Generally, you should leave this report on.



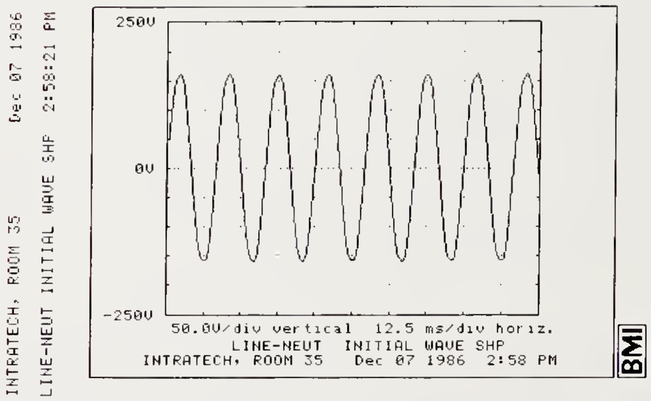
```
INTRATECH, ROOM 35          Dec 07 1986

THRESHOLD REPORT                2:58 PM

Type:       Single phase

LINE-NEUT THRESHOLDS (Channel 1)
      Surge voltage:  125.0 Vrms
      Sag voltage:    105.0 Vrms
      Impulse:          200 Vpk
      High freq noise:  5.0 Vpk
      High frequency:  61.2 Hz
      Low  frequency:  58.8 Hz
      Wave shape:       20% variation
      Minimal duration: 0.1 cycles
      Line impedance:    50 ohms
      Hysteresis:      1.0%

NEUT-GND THRESHOLDS (Channel 2)
      Surge voltage:    5.0 Vrms
      Impulse:          100 Vpk
      High freq noise:  5.0 Vpk
      Line impedance:    50 ohms
      Hysteresis:      1.0%

SUMMARY REPORT INTERVAL:  1Hr

1 HOUR STRIP CHARTS
      LINE-NEUT Rms Voltage
      LINE-NEUT Hi Freq Noise
      LINE-NEUT Frequency
      NEUT-GND Rms Voltage
      NEUT-GND Hi Freq Noise

Internal UPS time:   5 minutes.
```

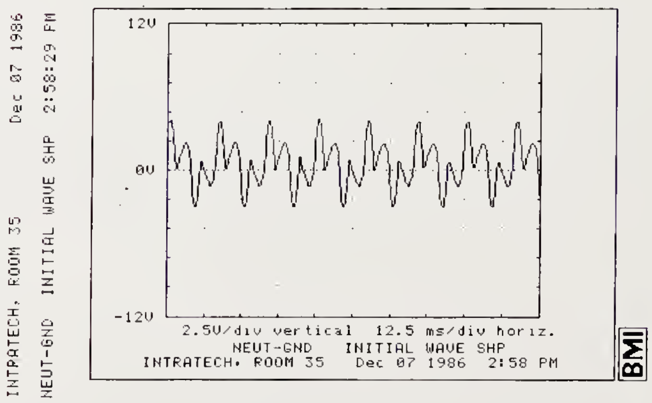
Initial waves: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn the initial waveshape graphs on or off.

Your PowerScope prints initial waveshape graphs after the Threshold Report. These graphs show the initial condition of the sine-waves. Generally, you should leave these graphs on.





HELP!

```
Use the VALUE UP/VALUE DOWN keys to
turn the Threshold Report on or off.
This report should normally be left
on.

(Press HELP! again for more infor-
mation on Threshold Reports).
```

```
The Threshold Report is the list of
thresholds and settings your
PowerScope can print automatically
before it begins monitoring.

(If you turn the Threshold Report
on now, you can still omit it when
you begin monitoring by pressing
the MONITOR key followed immediately
by the UP ARROW key.)

(Press HELP! again for general infor-
mation on the Report Menu).
```

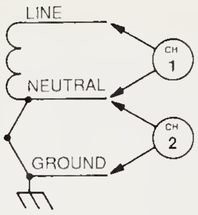
```
Use the VALUE UP/VALUE DOWN keys to
turn the Initial Waveshape Report on
or off. This report should normally
be left on.

(Press HELP! again for more infor-
mation on the Initial Waveshape
Report).
```

```
The Initial Waveshape Report shows the
condition of the sine waves at the
beginning of the monitoring session.
Initial waveshapes may give you
additional information on the
condition of the power lines.

(Press HELP! again for general infor-
mation on the Report Menu).
```

```
The Report Menu contains questions
that define the type of summary strip
charts you would like, and over what
time duration you would like them.

The questions in the Report Menu
vary depending on the type of power
each channel is monitoring, and if
you have probes plugged into the
environmental channels.

(Press HELP! again for general
information on the operating
sequence.
```

```
The usual sequence for operating
the PowerScope monitor is:

  1) Press the SETUP MENU key and
     answer the questions.
     To go on to the next question,
     press the Down Arrow.

  2) Connect the monitor to the
     power line. (See the HELP!
     message in the Setup Menu
     for the 'TYPE:' question.)

  3) Press the MONITOR key to monitor
     the power line.  Your reports
     will be printed automatically.

(Press HELP! again for general infor-
mation on the six modes of operation.)
```

```
The PowerScope monitor can be in one
of six modes:

   1) Press the SETUP MENU key to
      program the Setup Menu.
      Use the up arrow and the down
      arrow key to work your way
      through the questions on the
      menu. The 'HELP!' key will
      always give you information
      on a question on the menu.
      (You may want to press 'HELP!'
      when you have selected the type
      of power line you are going to
      monitor. This will give you
      installation instructions.)

      By pressing the SETUP MENU key,
      then immediately pressing the
      UP ARROW key, you will enter
      the key Operator Menu.  This
      menu will give you control of
      the detailed operation of the
      PowerScope.

   2) Press the STATUS key to print
      the Status Report.  This
      report tells you the present
      voltage, frequency, and noise
      on each of the channels.  This
      report can be especially
      useful when you're trying to
      set the thresholds correctly.
      It's also useful for checking
      to see if you've installed the
      monitor correctly.

   3) Press the REPORT MENU key to
      enter the Report menu.  Use
      the up arrow and the down
      arrow to work your way through
      the questions on the menu.
      The 'HELP!' key will always
      give you information on a
      question on the menu.

   4) Press the MONITOR key to start
      monitoring the power line.
      The PowerScope will print a
      complete copy of your setup,
      and show you the initial wave-
      shapes on each channel (if you
      have requested them in the
      Report Menu).  Then it will
      print a disturbance report
      every time a power disturbance
      occurs.

   5) Press the SELF CALIBRATE key
      to calibrate your PowerScope.
      The PowerScope has the ability
      to completely calibrate itself.
      A Calibration Report will be
      printed automatically, showing
      the calibration of all of the
      ranges on all of the channels.

   6) Press the SELF TEST key to test
      the PowerScope.

(There is no more HELP!)
```

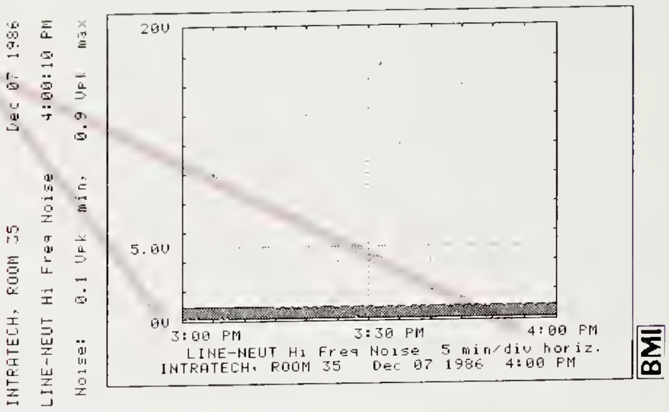


Report Menu, continued

Strip charts: 1Hr

Selections: 24Hr
12Hr
6Hr
3Hr
1Hr
Off

Use the VALUE UP/ VALUE DOWN keys to set the strip chart interval.



```
INTRATECH, ROOM 35          Dec 07 1986
LINE-NEUT Hi Freq Noise     4:00:10 PM
Noise:  0.1 Vpk  min,   0.9 Vpk  max
```

This is a Strip Chart.

```
INTRATECH, ROOM 35          Dec 07 1986

STRIP CHART REPORT               4:00 PM
 From  3:00 PM  To  4:00 PM

LINE-NEUT  (Channel 1)
 Rms:    111.3 Vrms min, 120.1 Vrms max
 Noise:    0.1 Vpk  min,   0.9 Vpk  max
 Freq:    60.0 Hz   min,  60.0 Hz   max
 Imp:        0 counted

NEUT-GND  (Channel 2)
 Rms:      1.8 Vrms min,   3.1 Vrms max
 Noise:    0.7 Vpk  min,   1.3 Vpk  max
 Imp:        0 counted
```

This is a Summary Strip Chart Report.

If you choose:

24 hr – strip charts will be printed every 24 hours at midnight.
12 hr – strip charts will be printed every 12 hours beginning at 12:00.
6 hr – strip charts will be printed every 6 hours beginning at 6:00.
3 hr – strip charts will be printed every 3 hours beginning at 3:00.
1 hr – strip charts will be printed every hour on the hour.
Off – no long-term summary information will be printed.

NOTE: Whatever strip chart interval you choose here will appear in the forthcoming questions.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the time interval between printing strip charts and summary reports.

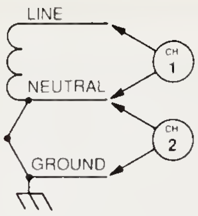
Possible selections are: 24 hours, 12 hours, 6 hours, 3 hours, 1 hour, or OFF. The interval that you choose impacts the choices offered you in the next series of questions.

(Press HELP! for more information on selecting strip chart summary reports).

If you choose, for example, 12-hour strip chart summaries, your choices in the next questions regarding individual strip chart summary reports will include 12-hour strip charts. (If you choose 3-hour strip charts here, your choices in the next questions will include 3-hour strip charts, and so on.)

(Press HELP! for general information on the Setup Menu.)

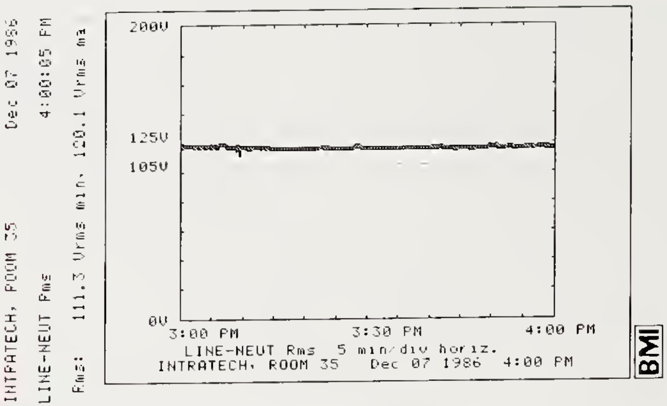
Report Menu, continued



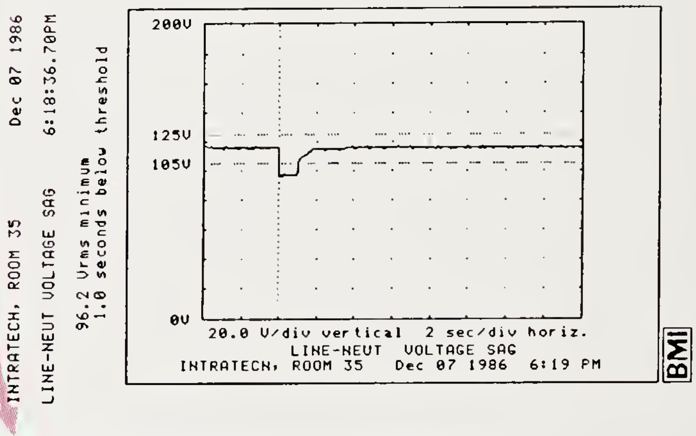
LINE-NEUT RMS: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the line-to-neutral Rms signal.



1-Hr strip chart: line-to-neutral Rms.



Graph: line-to-neutral Rms disturbance.

If you choose:

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

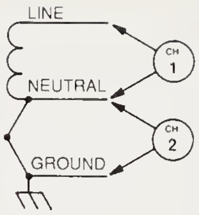
Both - your PowerScope will print both strip charts and graphs.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a disturbance graph of this
signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance graphs.

If you choose GRAPH, your PowerScope
will graph all disturbances for this
signal but will not print a strip
chart for this signal.

If you choose OFF, your PowerScope
will print neither disturbance graphs
nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu, you
will not have the choice of a strip
chart summary in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

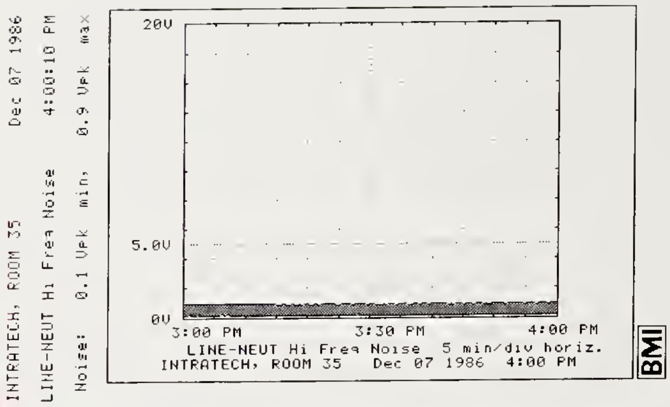
Report Menu, continued



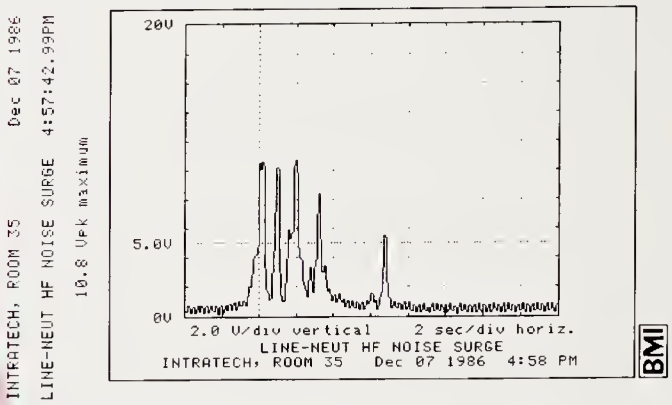
LINE-NEUT HFN: Both

Selections:	Both
	1 Hr
	Graph
	Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the line-to-neutral high-frequency noise signal.



1-Hr strip chart: line-to-neutral high-frequency noise.



Graph: line-to-neutral high-frequency noise.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

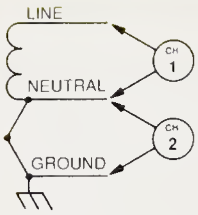
Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal, however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a disturbance graph of this
signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance graphs.

If you choose GRAPH, your PowerScope
will graph all disturbances for this
signal but will not print a strip
chart for this signal.

If you choose OFF, your PowerScope
will print neither disturbance graphs
nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu, you
will not have the choice of a strip
chart summary in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

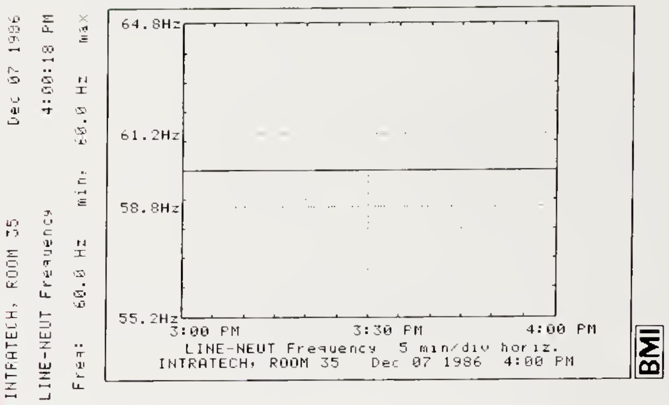
Report Menu, continued



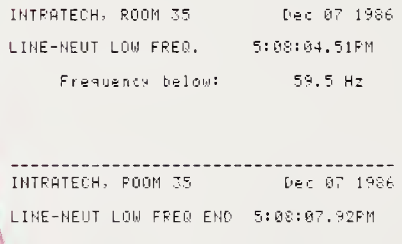
LINE-NEUT FREQ: Both

Selections: Both
1 Hr
Text
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the line-to-neutral frequency signal.



1-Hr strip chart: line-to-neutral frequency.



```
INTRATECH, ROOM 35          Dec 07 1986
LINE-NEUT LOW FREQ.      5:08:04.51PM
     Frequency below:         59.5 Hz


----------------------------------------
INTRATECH, ROOM 35          Dec 07 1986
LINE-NEUT LOW FREQ END   5:08:07.92PM
     Minimum frequency:       57.9Hz
```

Text report: line-to-neutral frequency.

If you choose:

Both - your PowerScope will print both strip charts and text disturbance reports.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print text disturbance reports.

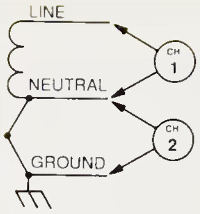
Text - your PowerScope will print text disturbance reports of this signal, but won't print strip charts.

Off - no text disturbance reports or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above, (3) TEXT, and (4)
OFF.

If you select BOTH, your PowerScope
will print both a strip chart
summary and a textual disturbance
reports of this signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance reports.

If you choose TEXT, your PowerScope
will print a textual report of all
disturbances for this signal but
will not print a strip chart for
this signal.

If you choose OFF, your PowerScope
will print neither textual reports
 nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu,
you will not have the choice of
strip chart summaries in this
question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

Report Menu, continued

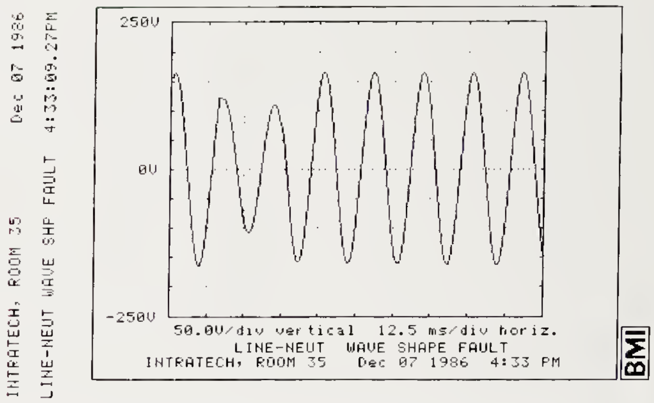


LINE-NEUT Wave: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn line-to-neutral waveshape fault graphs on or off.

Generally, you will leave this report on.

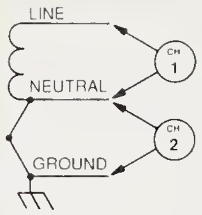


This is a line-to-neutral waveshape fault graph.

HELP!

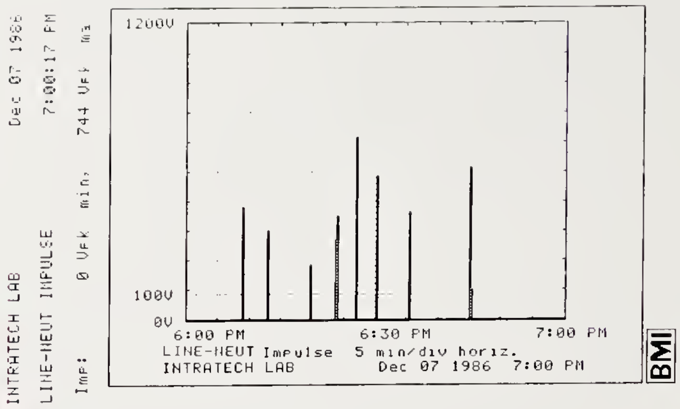
```
Use the VALUE UP/VALUE DOWN keys to
turn on or off the Waveshape fault
disturbance reporting for this signal.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

Report Menu, continued

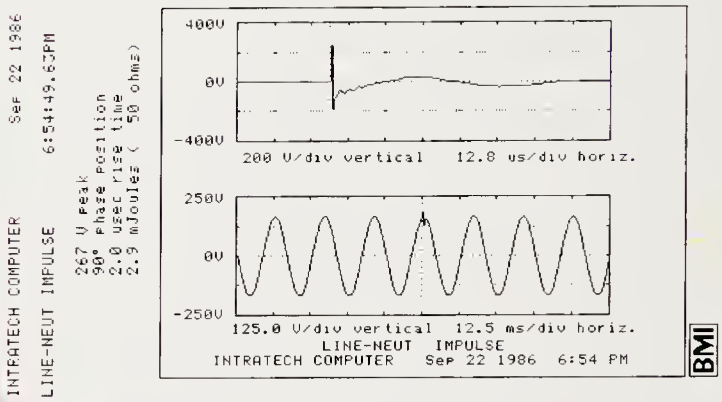


LINE-NEUT Imp: Both

Selections: Both
1 Hr
Graph
Off



1-Hr strip chart: impulse.



Graph: impulse.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

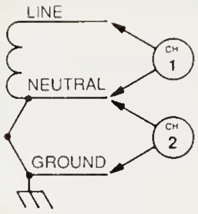
Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the maximum reading of this signal will be reported textually in the summary reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a disturbance graph of this
signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance graphs.

If you choose GRAPH, your PowerScope
will graph all disturbances for this
signal but will not print a strip
chart for this signal.

If you choose OFF, your PowerScope
will print neither disturbance graphs
nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu, you
will not have the choice of a strip
chart summary in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

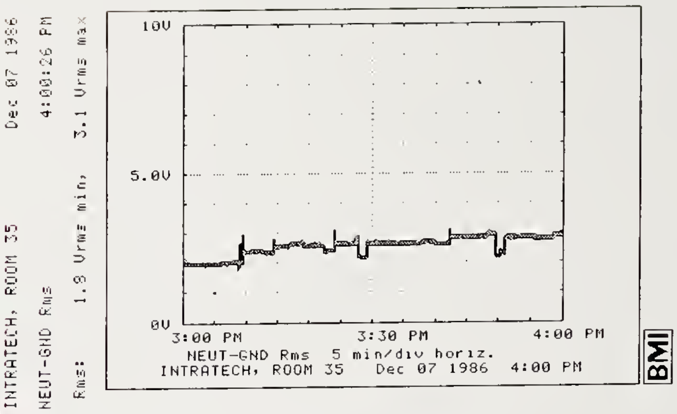
Report Menu, continued



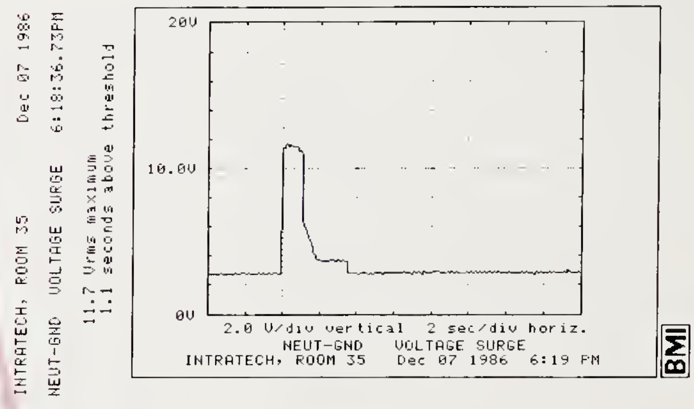
NEUT-GND Rms: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the neutral-to-ground Rms signal.



1-Hr strip chart: neutral-to-ground Rms.



Graph: neutral-to-ground surge.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

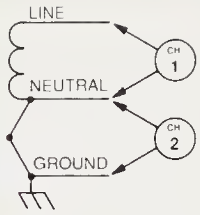
Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a disturbance graph of this
signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance graphs.

If you choose GRAPH, your PowerScope
will graph all disturbances for this
signal but will not print a strip
chart for this signal.

If you choose OFF, your PowerScope
will print neither disturbance graphs
nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu, you
will not have the choice of a strip
chart summary in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

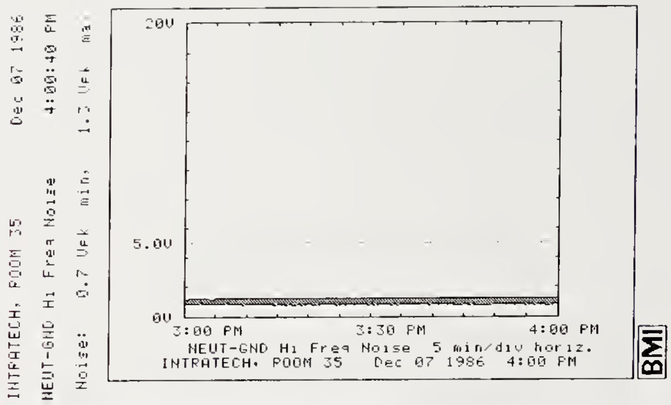
Report Menu, continued



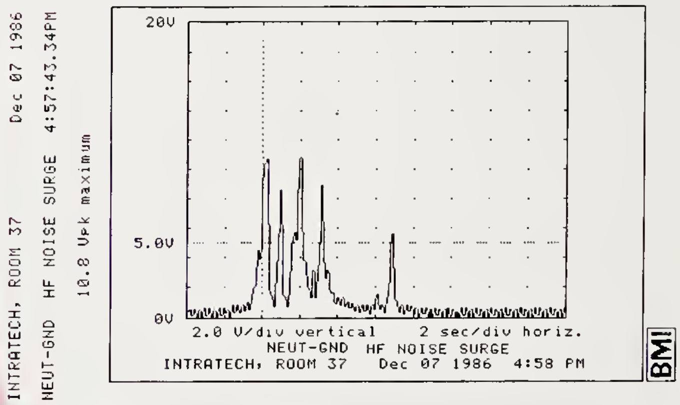
NEUT-GND HFN: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the neutral-to-ground high-frequency noise signal.



1-Hr strip chart: neutral-to-ground high-frequency noise.



Graph: neutral-to-ground high-frequency noise.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

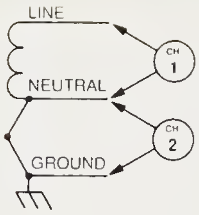
If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

(Press HELP! again for general information on the Report Menu.)

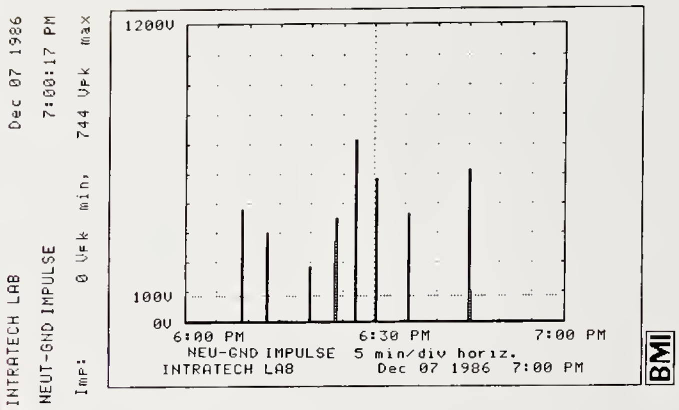


Report Menu, continued

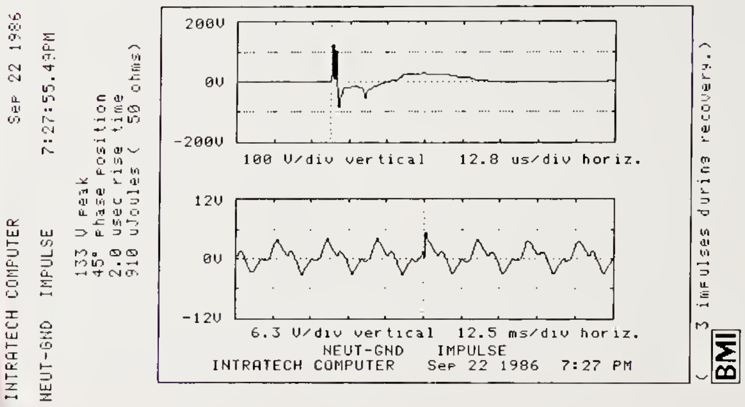
NEUT-GND Imp: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for neutral-to-ground impulses.



1-Hr strip chart: neutral-to-ground impulse.



Graph: impulse.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the maximum reading of this signal will be reported textually in the summary reports.

If you are using probes, there will be more questions. See page 286 for an explanation of Report Menu questions for probes.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

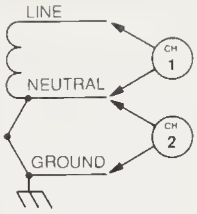
If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

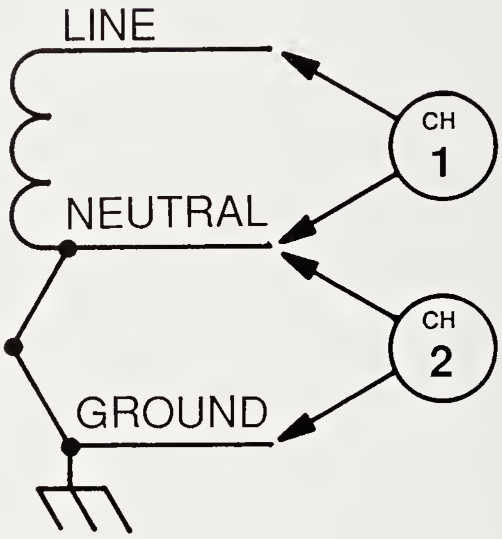
If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

(Press HELP! again for general information on the Report Menu.)



Part 3: Connecting To Single-Phase

Part 3 discusses how to connect your PowerScope for monitoring single-phase power.

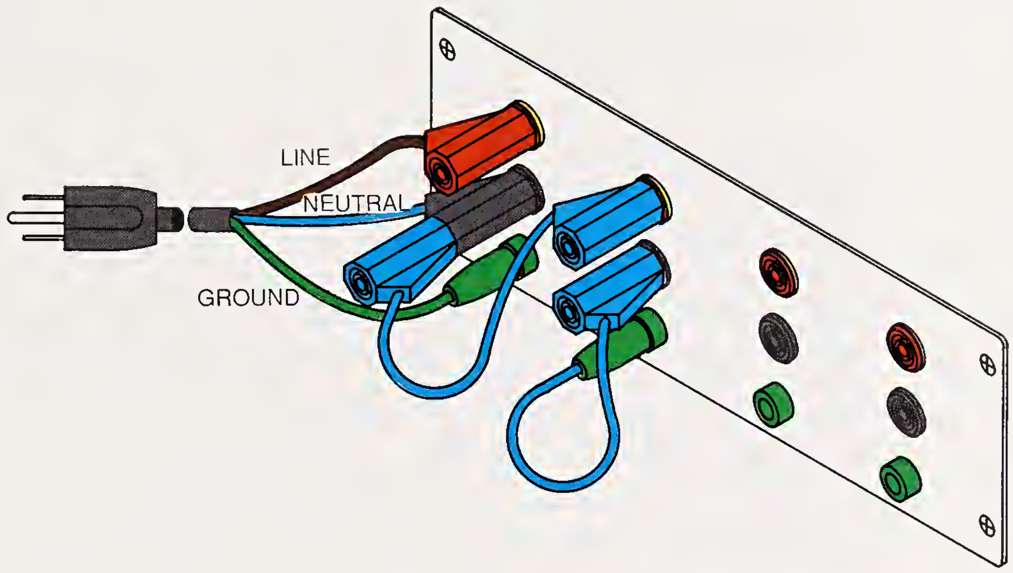


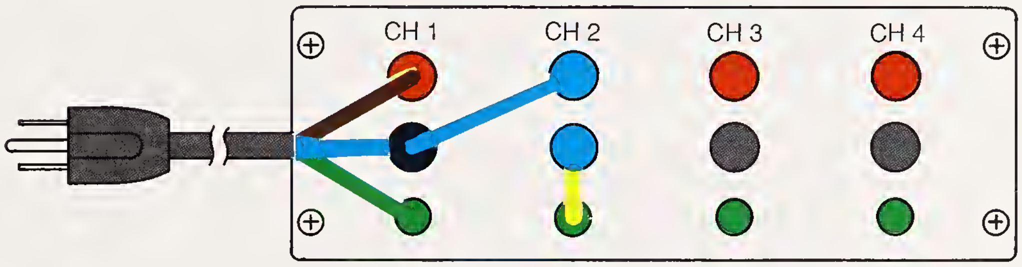
To monitor both lines (phase-to-neutral and neutral-to-ground) of single-phase power requires two channels.

Using the single phase measuring cable:

1. Connect the green (ground) connector to ground.
2. Connect the red safety connector to Channel 1 red (positive).
3. Connect the black safety connector to a blue jumper connected into Channel 1 black (negative).
4. Connect the other end of the blue jumper into Channel 2 red (positive).
5. Connect another blue jumper cable from Channel 2 black (negative) to ground.

WARNING
You are working with high voltages that cause burns and lethal shocks. Connect the safety earth ground first. USE STANDARD SAFETY PRECAUTIONS.

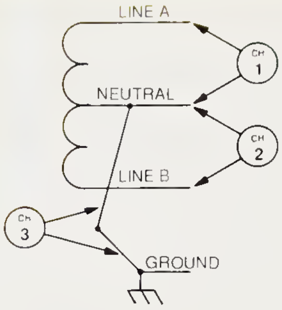


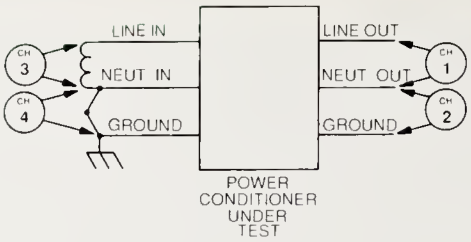


Press the STATUS key to get a printout verifying that you've connected correctly, and that your initial readings are within the thresholds you've set.

```
INTRATECH, ROOM 35          Dec 07 1986

STATUS REPORT                   4:29 PM

LINE-NEUT (Channel 1)
   Voltage:      115.5 - 117.2 Vrms
   Frequency:     60.0 -  60.0 Hz
   Hi freq noise:  1.0 -   2.1 Vpk

NEUT-GND (Channel 2)
   Voltage:        2.8 -   2.9 Vrms
   Hi freq noise:  1.0 -   1.2 Vpk

BATTERY CONDITION
   Voltage:    11.8 Vdc
   State:       Charged
```

Press the MONITOR key to begin monitoring.





You can use this chapter for monitoring split single-phase power, or for monitoring the input and output of a single-phase power conditioner.

Quick Guide

1. Press the SETUP MENU key.

2. Answer the questions in the menu using the VALUE UP/ VALUE DOWN keys or the number keypad.

3. Press the down arrow key to go on to the next question.

4. Press the HELP! key if you want further explanation about the question or on what to do next.

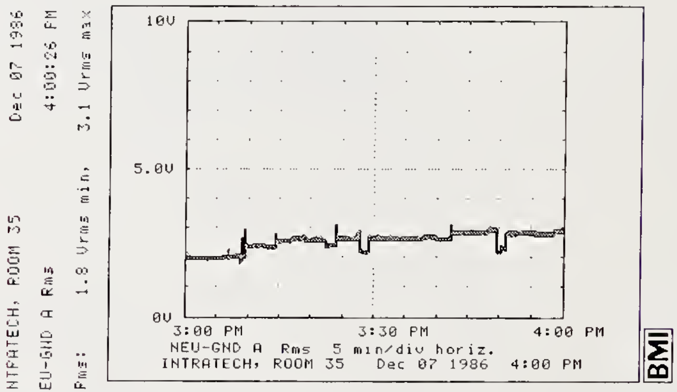
Press the SETUP MENU key now.

If you get the following message in the display, it's because the PowerScope has strip charts from a previous monitoring period:

Summary rpts: Print

Possible selections: Print
Clear

Use the VALUE UP/ VALUE DOWN keys to choose whether you want the pending strip charts.



This is a summary strip chart.

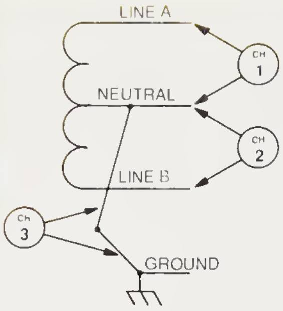
If you want them printed then erased, position PRINT in the display, then press the down arrow. If you want them erased immediately, position CLEAR in the display, then press the down arrow.

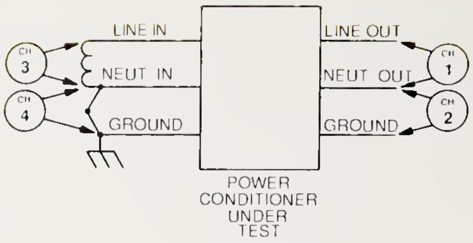
Then press the SETUP MENU key again and proceed.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select PRINT or CLEAR and then
use the DOWN ARROW key to enter
the menu you have selected.

If you select PRINT, the summary data
and strip charts that have been
gathered so far by the PowerScope will
be printed and then reset. If you
select CLEAR, all of the summary
data and strip charts will be reset
without printing.

If you don't want to lose any summary
data, you may return to the Monitor
mode by pressing the MONITOR key.
```

Setup Menu, continued

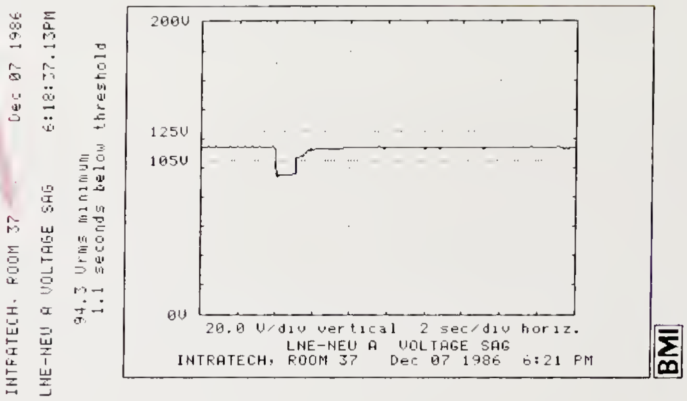




Site: INTRATECH, ROOM 37

Use the number keys to enter the name of the site where you are monitoring.

Use the left and right arrow keys to move the flashing cursor.


INTRATECH, ROOM 37   Dec 07 1986
LNE-NEU A VOLTAGE SAG   6:18:37.13PM
94.3 Vrms minimum
1.1 seconds below threshold

20.0 V/div vertical   2 sec/div horiz.
LNE-NEU A   VOLTAGE SAG
INTRATECH, ROOM 37   Dec 07 1986   6:21 PM

Use the number keys to enter both letters and numbers; for example, to enter the letter "K", press the 5JKL key 3 times. On the first press, a 5 will appear, on the second a J, and on the third, a K will appear.

Now move the flashing cursor to the next position by pressing the right arrow key. Press the 0 SPACE key twice to enter a space. Press the down arrow key to go on to the next question.

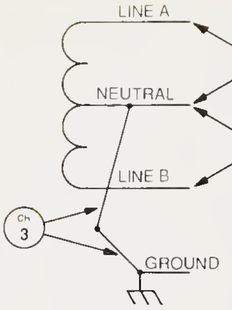
HELP!

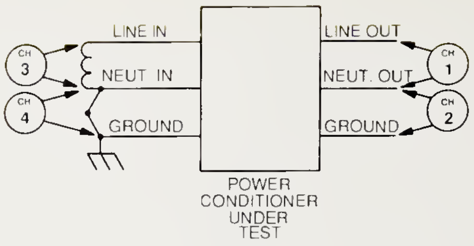
```
You may enter up to 20 characters from
the keyboard to identify the site
that you are monitoring.

Use the left and right arrow keys to
move the flashing cursor.

Use the number keys to enter both
letters and numbers.  For example,
to enter the letter 'B', push the
'2ABC' key three times.

(Press HELP! again for general
information on the Setup Menu.)
```

```
The Setup Menu contains questions that
define the operating parameters of
your PowerScope.   Specifically, it
asks you to name the monitoring site,
state what type of power each channel
will monitor, and specify thresholds
for each measurement.

The questions in the Setup Menu change
automatically depending on what type
of power you assign each channel and
if you have probes plugged into the
environmental channels.

(Press HELP! again for general infor-
mation on the operating sequence.)
```

```
The usual sequence for operating
the PowerScope monitor is:

  1) Press the SETUP MENU key and
     answer the questions.
     To go on to the next question,
     press the Down Arrow.

  2) Connect the monitor to the
     power line. (See the HELP!
     message in the Setup Menu
     for the 'TYPE:' question.)

  3) Press the MONITOR key to monitor
     the power line.  Your reports
     will be printed automatically.

(Press HELP! again for general infor-
mation on the six modes of operation.)

=======================================

=======================================

The PowerScope monitor can be in one
of six modes:

   1) Press the SETUP MENU key to
      program the Setup Menu.
      Use the up arrow and the down
      arrow key to work your way
      through the questions on the
      menu. The 'HELP!' key will
      always give you information
      on a question on the menu.
      (You may want to press 'HELP!'
      when you have selected the type
      of power line you are going to
      monitor. This will give you
      installation instructions.)

      By pressing the SETUP MENU key,
      then immediately pressing the
      UP ARROW key, you will enter
      the Key Operator Menu.  This
      menu will give you control of
      the detailed operation of the
      PowerScope.

   2) Press the STATUS key to print
      the Status Report.  This
      report tells you the present
      voltage, frequency, and noise
      on each of the channels.  This
      report can be especially
      useful when you're trying to
      set the thresholds correctly.
      It's also useful for checking
      to see if you've installed the
      monitor correctly.

   3) Press the REPORT MENU key to
      enter the Report menu.  Use
      the up arrow and the down
      arrow to work your way through
      the questions on the menu.
      The 'HELP!' key will always
      give you information on a
      question on the menu.

   4) Press the MONITOR key to start
      monitoring the power line.
      The PowerScope will print a
      complete copy of your setup,
      and show you the initial wave-
      shapes on each channel (if you
      have requested them in the
      Report Menu).  Then it will
      print a disturbance report
      every time a power disturbance
      occurs.

   5) Press the SELF CALIBRATE key
      to calibrate your PowerScope.
      The PowerScope has the ability
      to completely calibrate itself.
      A Calibration Report will be
      printed automatically, showing
      the calibration of all of the
      ranges on all of the channels.

   6) Press the SELF TEST key to test
      the PowerScope.

(There is no more HELP!)
```

Setup Menu, continued

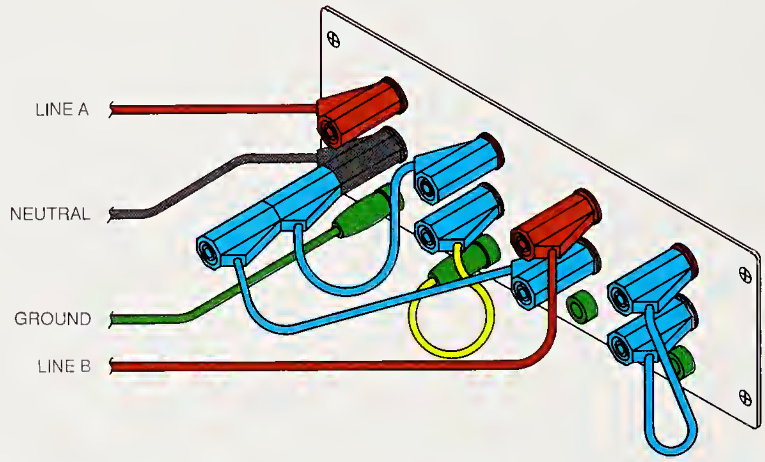




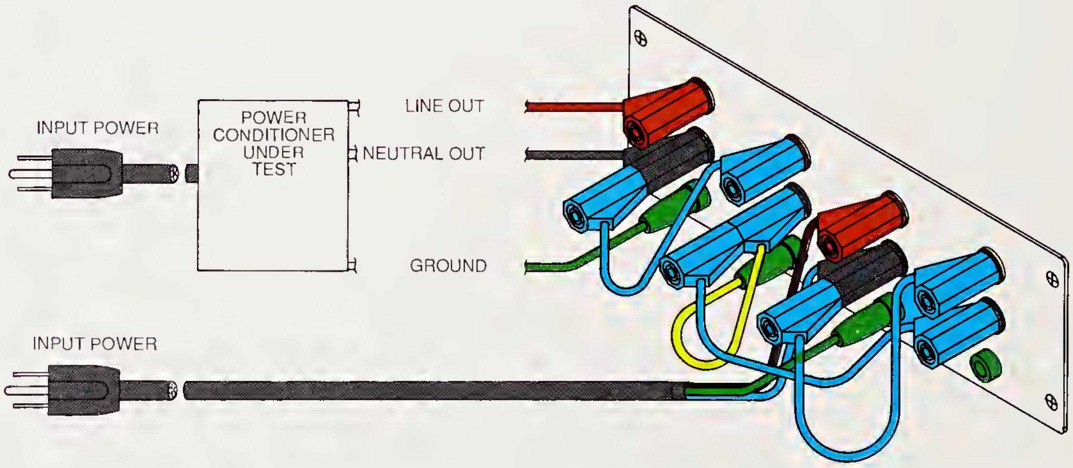
Type: Dual 1-phase

Selections: Single Phase
Dual 1-phase
3 phase delta
3 phase wye
Ind. channels

Use the VALUE UP/ VALUE DOWN keys to select Dual 1-phase power.



Split single-phase connection.



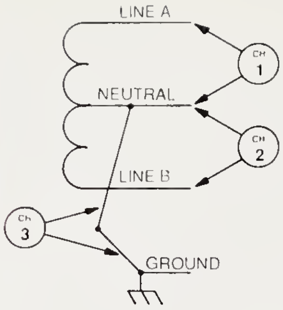
Power conditioner evaluation connection. Press the HELP! key for information on connecting your PowerScope to Dual-One Phase power, or see Part 3 of this chapter on page 94.

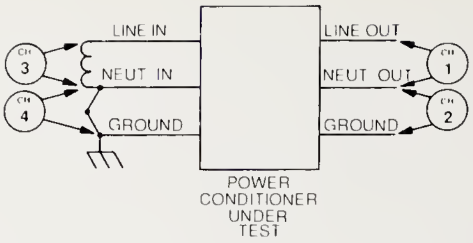
WARNING
You are working with high voltages that cause burns and lethal shocks. Connect the safety earth ground first. USE STANDARD SAFETY PRECAUTIONS.

HELP!

```
Select 'Dual 1-phase' to monitor two
independent single phase power lines
(for example, the input and output
of a power conditioning system).

To install the PowerScope on the two
single phase lines, make the
following connections:

Channel 1 GREEN terminal: SAFETY
                          GROUND

Channel 1 Red terminal:   Phase 1
Channel 1 Black terminal: Neutral 1

Channel 2 Red terminal:   Neutral 1
Channel 2 Black terminal: Ground 1

Channel 3 Red terminal:   Phase 2
Channel 3 Black terminal: Neutral 2

Channel 4 Red terminal:   Neutral 2
Channel 4 Black terminal: Ground 2

(Press HELP! again for general
information on the Setup Menu.)
```

Setup Menu, continued





Phase setup: A

Selections: A
B

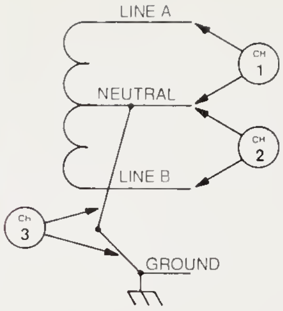
Use the VALUE UP/VALUE DOWN keys to choose which phase of dual-one power you will set thresholds for now, A or B.

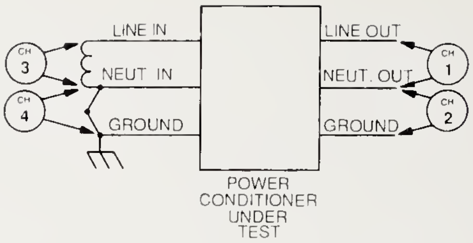
The thresholds that you choose for A (Channels 1 and 2) are completely independent of thresholds that you choose for B (Channels 3 and 4).

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
choose which line, A or B, you will
be setting thresholds for now.   The
thresholds for each are completely
independent of the other.

(Press HELP! again for general infor-
mation on the Setup Menu).
```

Setup Menu, continued



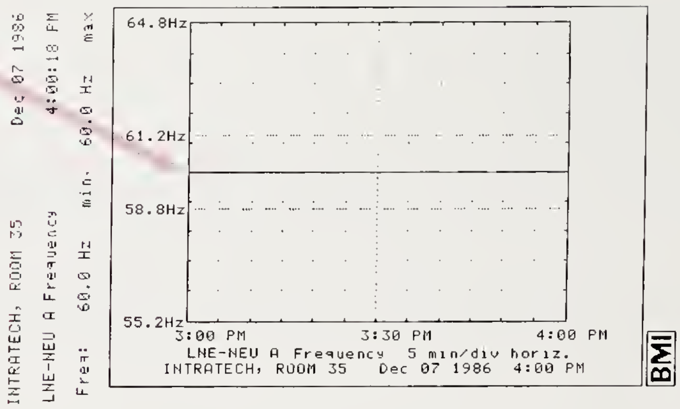


Nom. freq.: 60.0Hz

Range: 45.0Hz to 450Hz

Use the number keys to enter the nominal frequency of the line you are monitoring.

Typical values are 50.0 Hz, 60.0 Hz, 400.0 Hz, and 415.0 Hz.

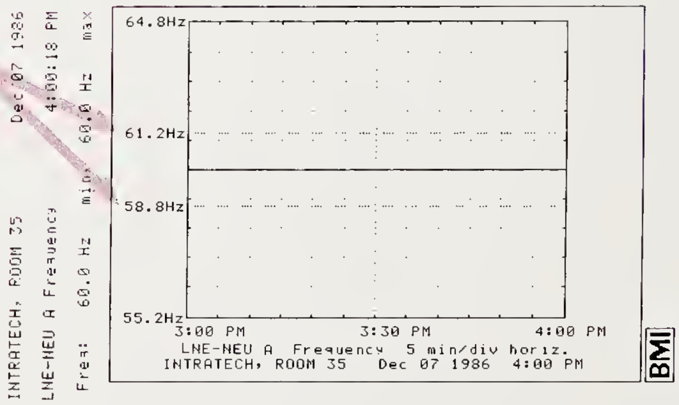


Freq. tol.: 1.2Hz

Range: 0.4Hz to 135.0Hz

Use the number keys to enter a threshold for line-frequency deviation.

The range is 1% to 30% of the nominal frequency, and is entered in Hertz. A typical value is 2% of the nominal frequency.



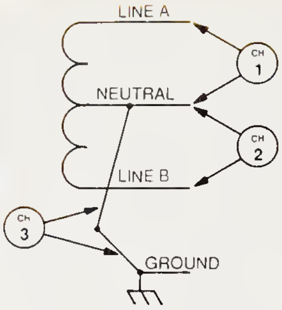
For example, if the nominal frequency setting is 50.0 Hz, the frequency tolerance range is .5 Hz (1%) to 15 Hz (30%).
If the frequency is 60.0 Hz, the frequency tolerance range is .6 Hz to 18 Hz.
If the frequency is 400.0 Hz, the frequency tolerance range is 4.0 Hz to 120 Hz.
If the frequency is 415.0 Hz, the frequency tolerance range is 4.15 Hz to 124.5 Hz.

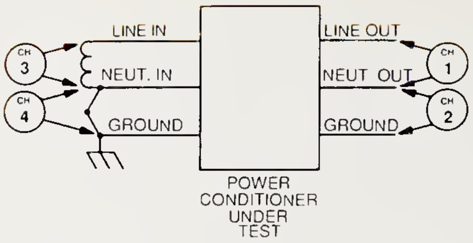
HELP!

```
Enter the nominal line frequency of
the line you are monitoring.  This
provides a reference to the monitor
from which it can base its measure-
ments. Typical values are 50.0 Hz,
60.0 Hz, and 400.0 Hz.  The
acceptable range is 45.0 Hz to
450.0 Hz.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

```
Enter in Hertz the amount of line
frequency deviation from nominal that
you are willing to tolerate before the
PowerScope reports a disturbance. The
range is 0.2% to 50% of your nominal
frequency setting.   A typical value
is 2% of your nominal frequency.

For example, if your nominal
frequency setting is 60 Hz., the range
is 0.1 Hz (0.2%) to 30.0 Hz (50%).
The default setting for 60 Hz is
1.2 Hz (2%).

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued

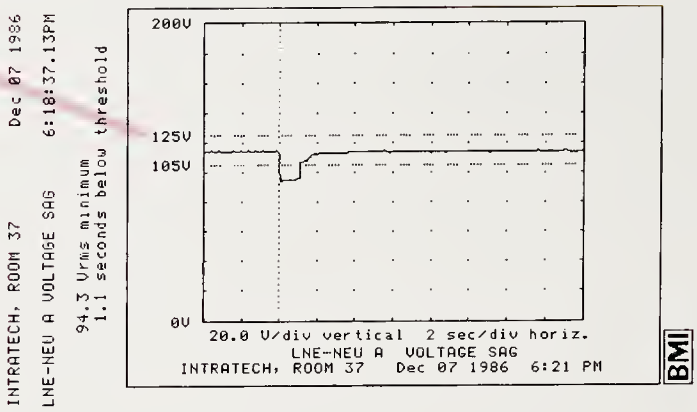




Surge volt: 125.0Vrms

Range: 1.0 Vrms to 600 Vrms

Use the number keys to enter the high-voltage threshold for line-to-neutral.



The usual value is about 10% above the nominal voltage. The acceptable range is 1.0 Vrms to 600.0 Vrms. The surge voltage threshold also determines the full-scale RMS voltage as follows:

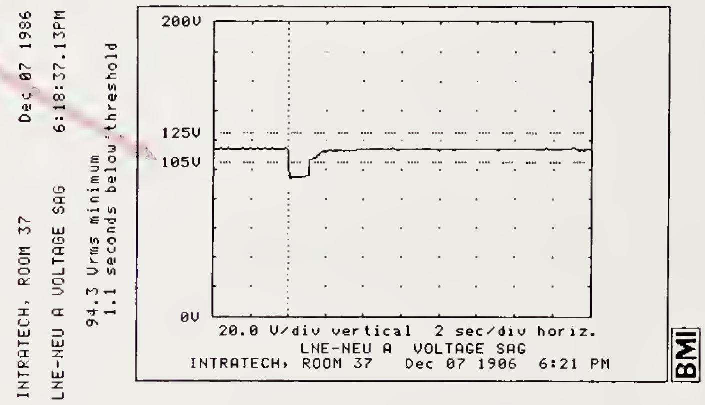
Voltage Surge Threshold Table

Surge Threshold	Full-Scale
1.0 - 6.2 Vrms	10.0 Vrms
6.3 - 12.5 Vrms	20.0 Vrms
12.6 - 25.0 Vrms	40.0 Vrms
25.1 - 62.5 Vrms	100.0 Vrms
62.6 - 125.0 Vrms	200.0 Vrms
125.1 - 166.5 Vrms	250.0 Vrms
166.6 - 250.0 Vrms	400.0 Vrms
250.1 - 600.0 Vrms	800.0 Vrms

Sag volt: 105.0Vrms

Range: 0.0 Vrms to 599 Vrms

Use the number keys to enter the low-voltage threshold for line-to-neutral phase.



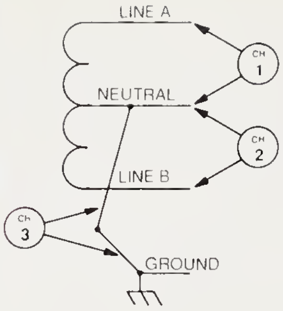
The usual value is about 15% below the nominal voltage. The acceptable range is 0.0 to 599.0 Vrms.

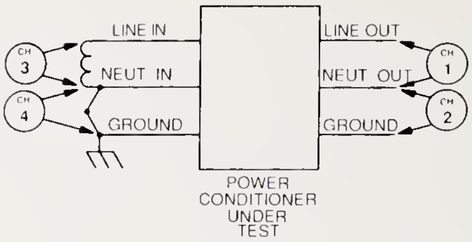
HELP!

```
Use the number keys to enter the
high voltage threshold.  The usual
value is about 10% above the nominal
voltage.  The acceptable range is
1.0 Vrms to 600.0 Vrms.

(Press HELP! again for general
information on the Setup Menu.)
```

```
Use the number keys to enter the low
voltage threshold.  The usual value is
about 15% below the nominal voltage.
The acceptable range is 0.0 Vrms to
599.9 Vrms.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued



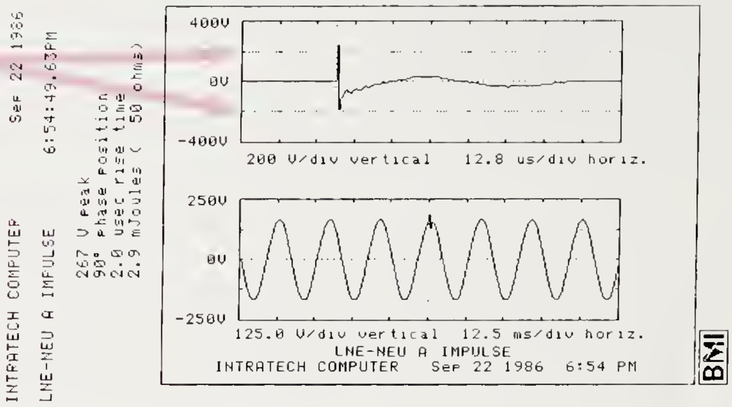


Impulse thr: 200 Vpk

Range: 20 Vpk to 6000 Vpk

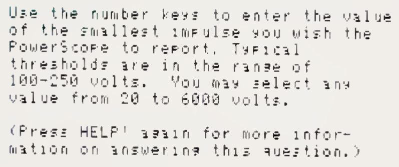
Use the number keys to enter the value of the smallest impulse the PowerScope should report on line-to-neutral A.

Typical thresholds are 100-250 volts. You may select any value from 20 Vpk to 6000 Vpk.

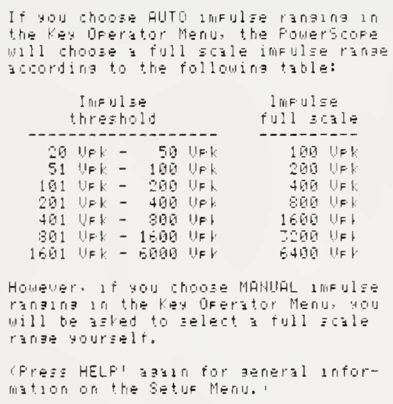


Line-to-neutral A impulse graph.

HELP!

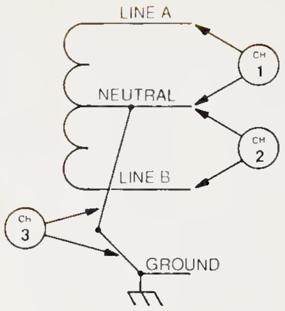


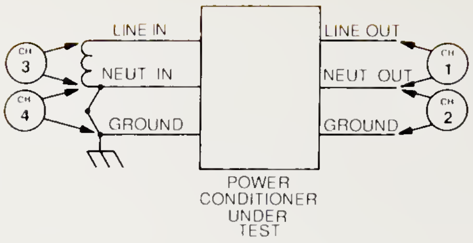
```
Use the number keys to enter the value
of the smallest impulse you wish the
PowerScope to report. Typical
thresholds are in the range of
100-250 volts.  You may select any
value from 20 to 6000 volts.

(Press HELP! again for more infor-
mation on answering this question.)
```



```
If you choose AUTO impulse ranging in
the Key Operator Menu, the PowerScope
will choose a full scale impulse range
according to the following table:

       Impulse              Impulse
      threshold            full scale
  -------------------      ----------
   20 Vpk -   50 Vpk         100 Vpk
   51 Vpk -  100 Vpk         200 Vpk
  101 Vpk -  200 Vpk         400 Vpk
  201 Vpk -  400 Vpk         800 Vpk
  401 Vpk -  800 Vpk        1600 Vpk
  801 Vpk - 1600 Vpk        3200 Vpk
 1601 Vpk - 6000 Vpk        6400 Vpk

However, if you choose MANUAL impulse
ranging in the Key Operator Menu, you
will be asked to select a full scale
range yourself.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued



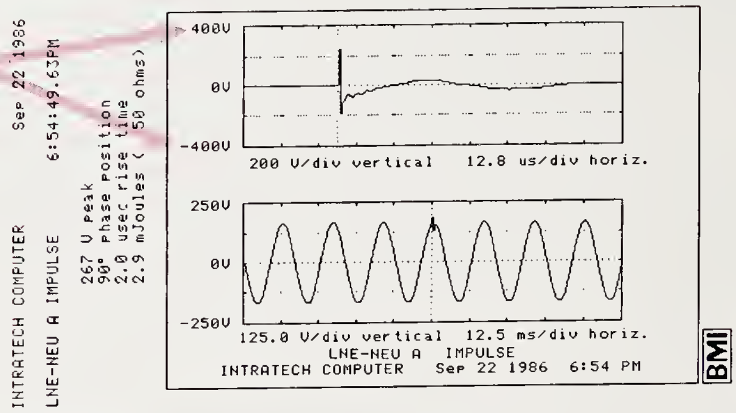


NOTE: The next question will only appear if you have Impulse Ranging in the Key Operator Menu set to MANUAL.

Imp. range: 400 Vpk

Possible selections: See table below.

Use the VALUE UP/ VALUE DOWN keys to select the full-scale impulse range for line-to-neutral A.



Line-to-neutral A impulse graph.

The selections depend on the impulse threshold, e.g. for a 20-24 Vpk threshold, there are 2 full-scale ranges availabe, 100 or 200 volts full-scale.

Manual Impulse Ranging Table

Impulse Threshold	Available Full-Scale Ranges
20-24 Vpk	+/-100 or 200 volts full-scale
24-49 Vpk	+/-100, 200 or 400 volts full-scale
50 Vpk	+/-100, 200, 400 or 800 volts full-scale
51-99 Vpk	+/-200, 400 or 800 volts full-scale
100 Vpk	+/-200, 400, 800 or 1600 volts full-scale
101-199 Vpk	+/-400, 800 or 1600 volts full-scale
200 Vpk	+/-400, 800, 1600 or 3200 volts full-scale
201-399 Vpk	+/-800, 1600 or 3200 volts full-scale
400 Vpk	+/-800, 1600, 3200 or 6400 volts full-scale
401-800 Vpk	+/-1600, 3200 or 6400 volts full-scale

If you selected AUTO Impulse Ranging in the Key Operator Menu (or plan to), the full-scale impulse range will be selected for you as follows:

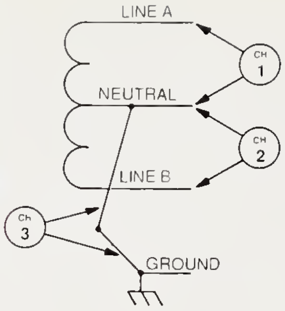
Automatic Impulse Ranging Table

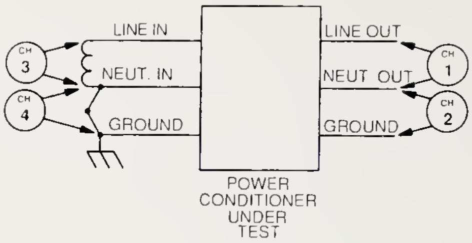
If Impulse Threshold selected in previous question is between...	The Impulse Range will set automatically to...
20 - 50 volts	+/- 100 volts
51 - 100 volts	+/- 200 volts
101 - 200 volts	+/- 400 volts
201 - 400 volts	+/- 800 volts
401 - 800 volts	+/- 1600 volts
801 - 1600 volts	+/- 3200 volts
1601- 6000 volts	+/- 6400 volts

HELP!

```
Use the VALUE UP/VALUE DOWN keys
to select the full scale impulse
range.  (If you want the PowerScope to
choose a range for you automatically,
use the Key Operator menu to select
AUTO impulse ranging.  The PowerScope
will automatically select a range that
will give you a good compromise
between resolution and dynamic range.)

(Press HELP! for more information on
selecting full scale ranges.)
```

```
The full scale impulse ranges are:

 100 Vpk
 200 Vpk
 400 Vpk
 800 Vpk
1600 Vpk
3200 Vpk
6400 Vpk

To preserve resolution, the
PowerScope will not allow you to
select a full scale range that is
less than two times your impulse
threshold or greater than 16 times
your impulse threshold:

Full scale      Acceptable thresholds
----------      ---------------------
  100 Vpk          20 Vpk -    50 Vpk
  200 Vpk          20 Vpk -   100 Vpk
  400 Vpk          20 Vpk -   200 Vpk
  800 Vpk          50 Vpk -   400 Vpk
 1600 Vpk         100 Vpk -   800 Vpk
 3200 Vpk         200 Vpk -  1600 Vpk
 6400 Vpk         400 Vpk -  6000 Vpk

(Press HELP! again for general infor-
mation on the Setup Menu.)
```



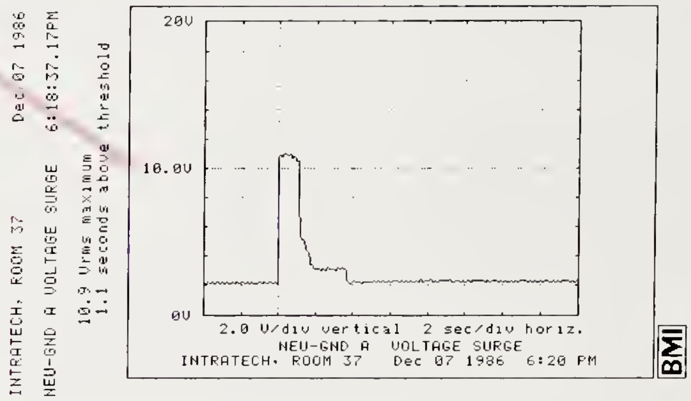


Neut-Gnd: 10.0Vrms

Range: 0.1 Vrms to 99.9 Vrms

Use the number keys to enter the voltage-surge threshold for neutral-to-ground A.

You may select any value from 0.1 Vrms to 99.9 Vrms. (Typical thresholds range between 1.0 and 10.0 Vrms.)



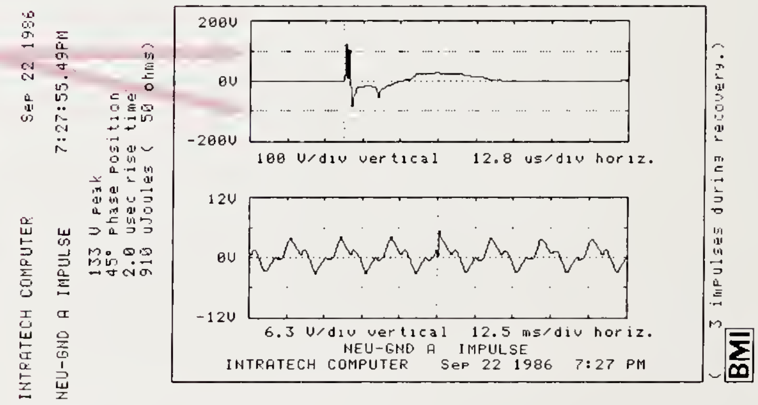
Neutral-to-ground A surge graph.

N-G imp thr: 100Vpk

Range: 20 Vpk to 6000 Vpk

Use the number keys to enter the smallest impulse you want the PowerScope to graph on neutral-to-ground A.

Typical thresholds are between 50-250 volts. You may select any value from 20 volts to 6000 volts.



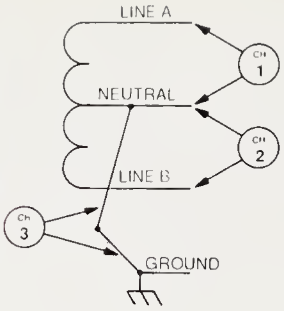
Neutral-to-ground A impulse graph.

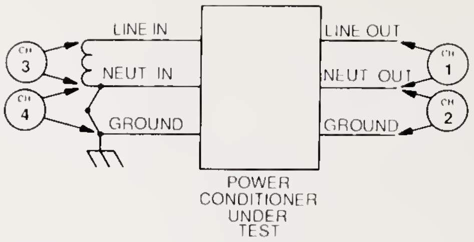
HELP!

```
Use the number keys to enter the
acceptable ac voltage difference
between the neutral and ground lines
being monitored by the PowerScope.
Typical thresholds are in the range
of 1.0-10.0 Vrms.  You may select any
value from 0.1 Vrms to 99.9 Vrms.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

```
Use the number keys to enter the
value of the smallest neutral-ground
impulse you wish the PowerScope to
report. Typical thresholds are in the
range of 50-250 volts.  You may
select any value from 20 to 6000
volts.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued





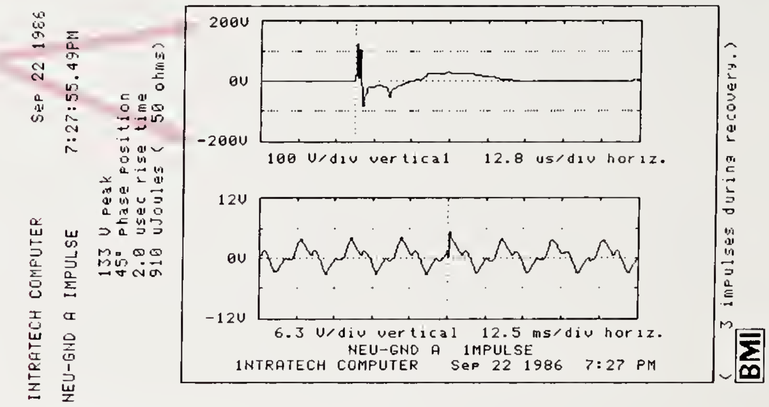
NOTE: You'll only get the next question if you have Impulse Ranging in the Key Operator Menu set to MANUAL.

N-G imp. range: 200 Vpk

Possible selections: See the following table.

The selections depend on the impulse threshold, e.g. for a 20 - 24 Vpk threshold, there are 2 full-scale ranges available, 100 or 200 volts full-scale.

Use the VALUE UP/ VALUE DOWN keys to select the full-scale impulse range for neutral-to-ground A.



Neutral-to-ground A impulse graph.

Manual Impulse Ranging Table

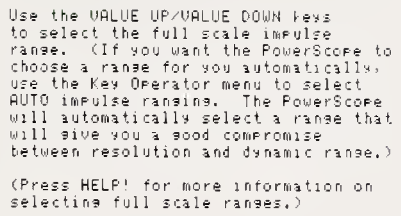
Impulse Threshold	Available Full-Scale Ranges
20-24 Vpk	+/-100 or 200 volts full-scale
24-49 Vpk	+/-100, 200 or 400 volts full-scale
50 Vpk	+/-100, 200, 400 or 800 volts full-scale
51-99 Vpk	+/-200, 400 or 800 volts full-scale
100 Vpk	+/-200, 400, 800 or 1600 volts full-scale
101-199 Vpk	+/-400, 800 or 1600 volts full-scale
200 Vpk	+/-400, 800, 1600 or 3200 volts full-scale
201-399 Vpk	+/-800, 1600 or 3200 volts full-scale
400 Vpk	+/-800, 1600, 3200 or 6400 volts full-scale
401-800 Vpk	+/-1600, 3200 or 6400 volts full-scale

If you selected AUTO Impulse Ranging in the Key Operator Menu (or plan to), the full-scale impulse range will be selected for you as follows:

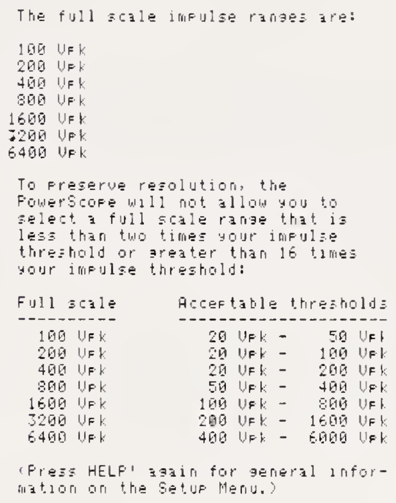
Automatic Impulse Ranging Table

Impulse Threshold	Full-Scale Range Set Automatically to...
20 - 50 volts	+/- 100 volts
51 - 100 volts	+/- 200 volts
101 - 200 volts	+/- 400 volts
201 - 400 volts	+/- 800 volts
401 - 800 volts	+/- 1600 volts
801 - 1600 volts	+/- 3200 volts
1601- 6000 volts	+/- 6400 volts

HELP!

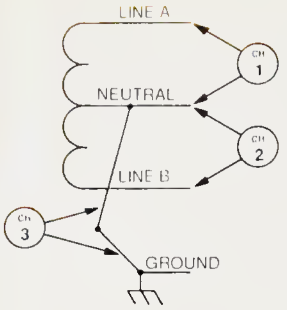


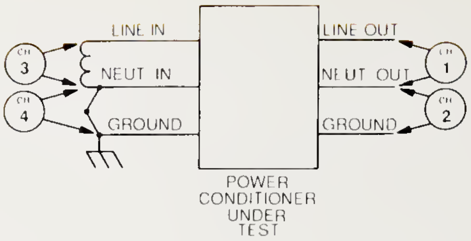
```
Use the VALUE UP/VALUE DOWN keys
to select the full scale impulse
range.  (If you want the PowerScope to
choose a range for you automatically,
use the Key Operator menu to select
AUTO impulse ranging.  The PowerScope
will automatically select a range that
will give you a good compromise
between resolution and dynamic range.)

(Press HELP! for more information on
selecting full scale ranges.)
```



```
The full scale impulse ranges are:

 100 Vpk
 200 Vpk
 400 Vpk
 800 Vpk
1600 Vpk
3200 Vpk
6400 Vpk

To preserve resolution, the
PowerScope will not allow you to
select a full scale range that is
less than two times your impulse
threshold or greater than 16 times
your impulse threshold:

Full scale      Acceptable thresholds
----------      ---------------------
  100 Vpk           20 Vpk -    50 Vpk
  200 Vpk           20 Vpk -   100 Vpk
  400 Vpk           20 Vpk -   200 Vpk
  800 Vpk           50 Vpk -   400 Vpk
 1600 Vpk          100 Vpk -   800 Vpk
 3200 Vpk          200 Vpk -  1600 Vpk
 6400 Vpk          400 Vpk -  6000 Vpk

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued





Phase setup: B

Selections: A
B

Use the VALUE UP/VALUE DOWN keys to choose which phase, A or B, you will be setting thresholds for now.

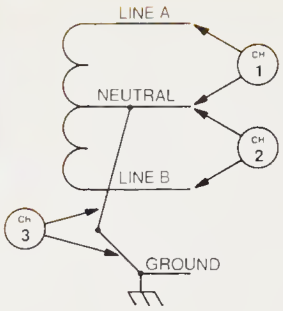
Assuming that you selected “A” at the start of this menu, you would now proceed to set thresholds for phase “B” of dual one-phase power.

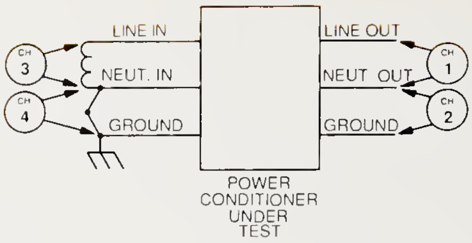
The questions are the same as for phase A. Refer to pages 54-64 for an explanation of these menu items. The last question in the Setup Menu for Dual-one phase power follows on page 68.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
choose which line, A or B, you will
be setting thresholds for now.   The
thresholds for each are completely
independent of the other.

(Press HELP! again for general infor-
mation on the Setup Menu).
```

Setup Menu, continued

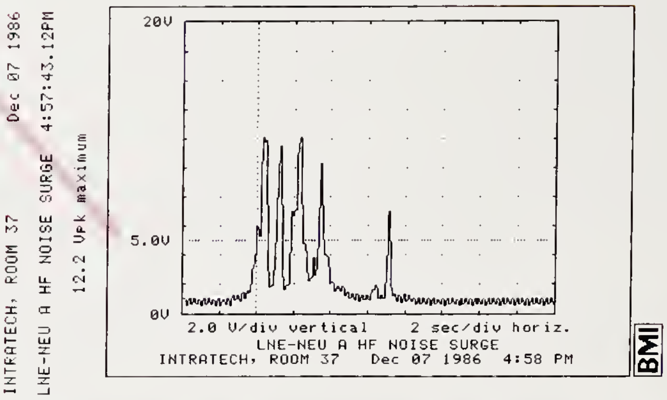




Hi. freq. noise: 5.0V

Range: 1.0V to 19.9V

Use the number keys to enter the high-frequency noise disturbance threshold (measured in peak-to-peak volts).



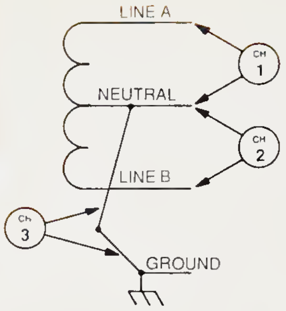
Line to Neutral A high frequency noise disturbance graph.

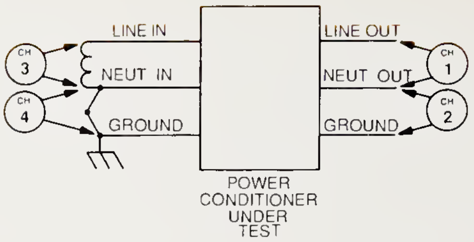
This value applies to all lines of the dual-one phase power line you are monitoring. A typical threshold is 5.0 Vpk. The acceptable range is 1.0 Vpk to 19.9 Vpk.

NOTE: If you are using probes for environmental monitoring there will be additional questions. See page 258 for an explanation of environmental thresholds.

HELP!

```
Use the number keys to enter the
high frequency noise disturbance
threshold (measured in peak-to-peak
volts).  A typical threshold is
5.0 Vpk.  The acceptable range is
1.0 Vpk to 19.9 Vpk.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```





The Report Menu lets you choose the graphs and summary reports your PowerScope prints. For a complete discussion of graphs and strip charts, see Appendix E.

Quick Guide

1. **Press the REPORT MENU key.**

2. **Use the VALUE UP/VALUE DOWN keys to answer the questions in the menu.**

3. **Press the down arrow to go to the next question.**

4. **Press the HELP! key if you want further explanation about the questions.**

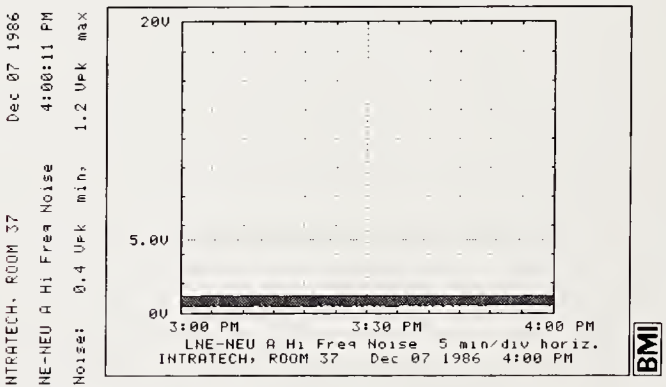
Press the REPORT MENU key now.

If you get the following message in the display, it's because the PowerScope has strip charts from the previous monitoring period.

Summary rpts: Print

Possible selections: Print
Clear

Press the VALUE UP/ VALUE DOWN keys to choose whether you want the pending strip charts.



This is a summary strip chart.

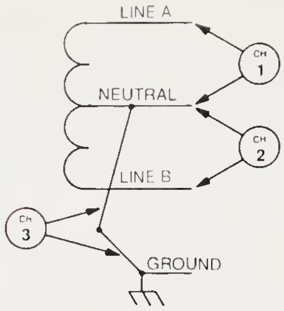
If you want them printed then erased, position PRINT in the display, then press the down arrow.
If you want them erased immediately, position CLEAR in the display, then press the down arrow.

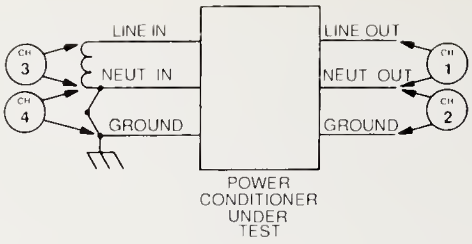
Then, press the REPORT MENU key again and proceed.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select PRINT or CLEAR and then
use the DOWN ARROW key to enter
the menu you have selected.

If you select PRINT, the summary data
and strip charts that have been
gathered so far by the PowerScope will
be printed and then reset. If you
select CLEAR, all of the summary
data and strip charts will be reset
without printing.

If you don't want to lose any summary
data, you may return to the Monitor
mode by pressing the MONITOR key.
```

Report Menu, continued





Threshold report: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn the Threshold Report on or off.

Your PowerScope prints the Threshold Report after you press the MONITOR key. The Threshold Report shows all the current settings. Generally, you should leave this report on.

If you don't want to see it as it begins printing, press the CANCEL PRINTER key.

If you don't want to see either the Threshold Report or the initial waveshape graphs, quickly press the up arrow key after pressing the MONITOR key and these reports will both be cancelled.

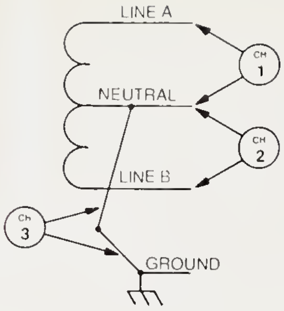
```
INTRATECH, ROOM 37           Dec 07 1986

THRESHOLD REPORT                 2:58 PM

Type:        Dual 1-phase

LNE-NEU A THRESHOLDS (Channel 1)
      Surge voltage:  125.0 Vrms
      Sag voltage:    105.0 Vrms
      Impulse:          200 Vpk
      High freq noise:  5.0 Vpk
      High frequency:  61.2 Hz
      Low  frequency:  58.8 Hz
      Wave shape:       10% variation
      Minimal duration: 0.1 cycles
      Line impedance:    50 ohms
      Hysteresis:      1.0%

NEU-GND A THRESHOLDS (Channel 2)
      Surge voltage:    5.0 Vrms
      Impulse:          100 Vpk
      High freq noise:  5.0 Vpk
      Line impedance:    50 ohms
      Hysteresis:      1.0%

LNE-NEU B THRESHOLDS (Channel 3)
      Surge voltage:  122.0 Vrms
      Sag voltage:    110.0 Vrms
      Impulse:          100 Vpk
      High freq noise:  5.0 Vpk
      High frequency:  60.6 Hz
      Low  frequency:  59.4 Hz
      Wave shape:       10% variation
      Minimal duration: 0.1 cycles
      Line impedance:    50 ohms
      Hysteresis:      1.0%

NEU-GND B THRESHOLDS (Channel 4)
      Surge voltage:    3.0 Vrms
      Impulse:           50 Vpk
      High freq noise:  5.0 Vpk
      Line impedance:    50 ohms
      Hysteresis:      1.0%

SUMMARY REPORT INTERVAL:  1Hr

1 HOUR STRIP CHARTS
      LNE-NEU A Rms Voltage
      LNE-NEU A Hi Freq Noise
      LNE-NEU A Frequency
      NEU-GND A Rms Voltage
      NEU-GND A Hi Freq Noise
      LNE-NEU B Rms Voltage
      LNE-NEU B Hi Freq Noise
      LNE-NEU B Frequency
      NEU-GND B Rms Voltage
      NEU-GND B Hi Freq Noise

Internal UPS time:   5 minutes.
```

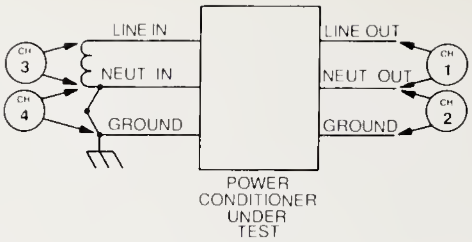
HELP!

```
Use the VALUE UP/VALUE DOWN keys to
turn the Threshold Report on or off.
This report should normally be left
on.

(Press HELP! again for more infor-
mation on Threshold Reports).

======================================

======================================

The Threshold Report is the list of
thresholds and settings your
PowerScope can print automatically
before it begins monitoring.

(If you turn the Threshold Report
on now, you can still omit it when
you begin monitoring by pressing
the MONITOR key followed immediately
by the UP ARROW key.)

(Press HELP! again for general infor-
mation on the Report Menu).

======================================

======================================

The Report Menu contains questions
that define the type of summary strip
charts you would like, and over what
time duration you would like them.

The questions in the Report Menu
vary depending on the type of power
each channel is monitoring, and if
you have probes plugged into the
environmental channels.

(Press HELP! again for general
information on the operating
sequence.

======================================

======================================

The usual sequence for operating
the PowerScope monitor is:

  1) Press the SETUP MENU key and
     answer the questions.
     To go on to the next question,
     press the Down Arrow.

  2) Connect the monitor to the
     power line. (See the HELP!
     message in the Setup Menu
     for the 'TYPE:' question.)

  3) Press the MONITOR key to monitor
     the power line.  Your reports
     will be printed automatically.

(Press HELP! again for general infor-
mation on the six modes of operation.)
```

```
The PowerScope monitor can be in one
of six modes:

   1) Press the SETUP MENU key to
      program the Setup Menu.
      Use the up arrow and the down
      arrow key to work your way
      through the questions on the
      menu. The 'HELP!' key will
      always give you information
      on a question on the menu.
      (You may want to press 'HELP!'
      when you have selected the type
      of power line you are going to
      monitor. This will give you
      installation instructions.)

      By pressing the SETUP MENU key,
      then immediately pressing the
      UP ARROW key, you will enter
      the Key Operator Menu.  This
      menu will give you control of
      the detailed operation of the
      PowerScope.

   2) Press the STATUS key to print
      the Status Report.  This
      report tells you the present
      voltage, frequency, and noise
      on each of the channels.  This
      report can be especially
      useful when you're trying to
      set the thresholds correctly.
      It's also useful for checking
      to see if you've installed the
      monitor correctly.

   3) Press the REPORT MENU key to
      enter the Report menu.  Use
      the up arrow and the down
      arrow to work your way through
      the questions on the menu.
      The 'HELP!' key will always
      give you information on a
      question on the menu.

   4) Press the MONITOR key to start
      monitoring the power line.
      The PowerScope will print a
      complete copy of your setup,
      and show you the initial wave-
      shapes on each channel (if you
      have requested them in the
      Report Menu).  Then it will
      print a disturbance report
      every time a power disturbance
      occurs.

   5) Press the SELF CALIBRATE key
      to calibrate your PowerScope.
      The PowerScope has the ability
      to completely calibrate itself.
      A Calibration Report will be
      printed automatically, showing
      the calibration of all of the
      ranges on all of the channels.

   6) Press the SELF TEST key to test
      the PowerScope.

(There is no more HELP!)
```

Report Menu, continued



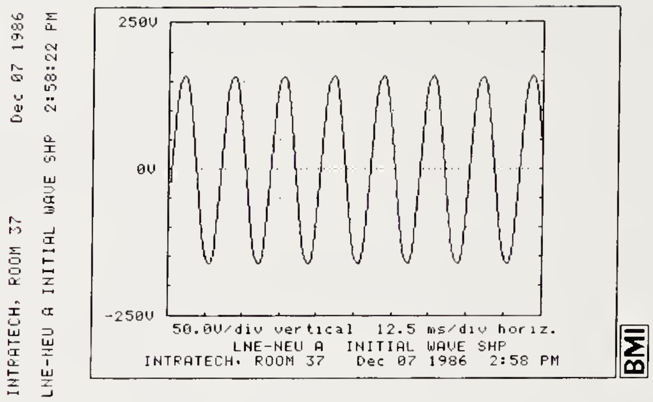


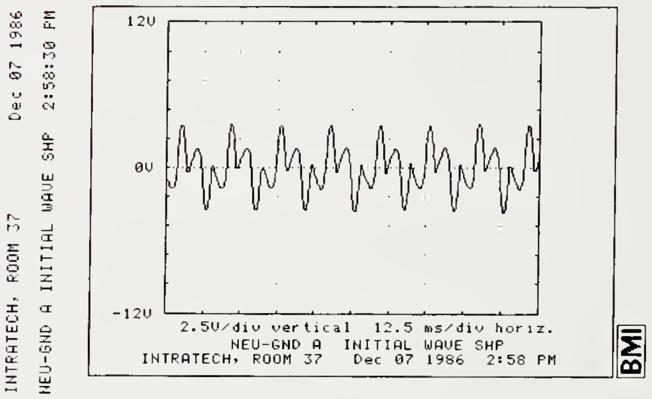
Initial waves: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn the initial waveshape graphs on or off.

Your PowerScope prints initial waveshape graphs after the Threshold Report These graphs show the intial condition of the sine waves. Generally, you should leave this report on.



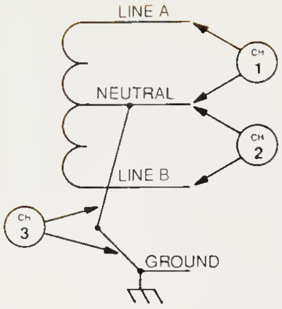


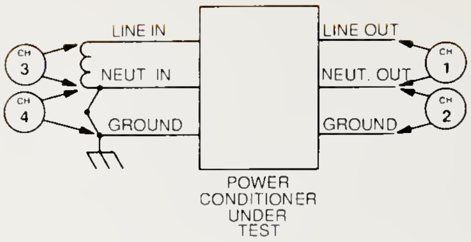
HELP!

```
Use the VALUE UP/VALUE DOWN keys to
turn the Initial Waveshape Report on
or off. This report should normally
be left on.

(Press HELP! again for more infor-
mation on the Initial Waveshape
Report).
```

```
The Initial Waveshape Report shows the
condition of the sine waves at the
beginning of the monitoring session.
Initial waveshapes may give you
additional information on the
condition of the power lines.

(Press HELP! again for general infor-
mation on the Report Menu).
```

Report Menu, continued

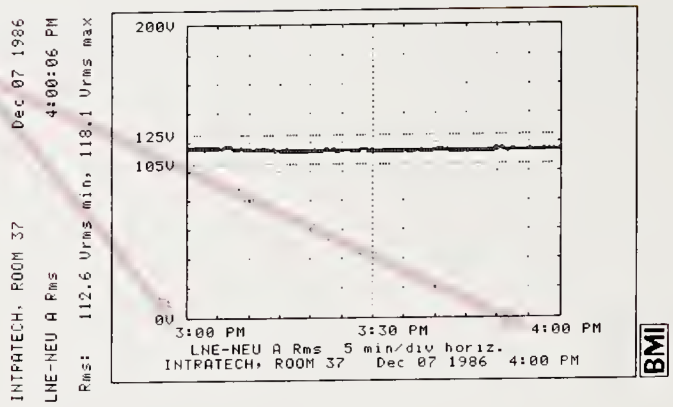




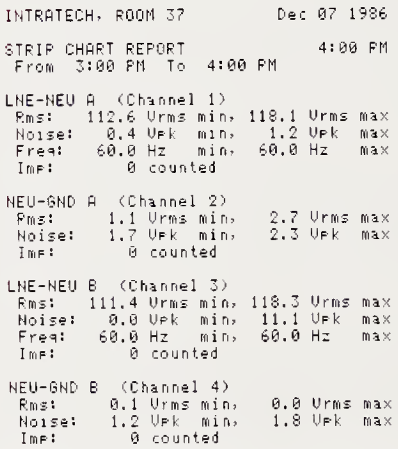
Strip charts: 1 Hr

Selections: 24 Hr
12 Hr
6 Hr
3 Hr
1 Hr

Use the VALUE UP/ VALUE DOWN keys to set the strip chart interval.



This is a 1-Hr strip chart.



```
INTRATECH, ROOM 37          Dec 07 1986

STRIP CHART REPORT              4:00 PM
 From  3:00 PM  To  4:00 PM

LNE-NEU A  (Channel 1)
 Rms:   112.6 Vrms min, 118.1 Vrms max
 Noise:   0.4 Vpk  min,   1.2 Vpk  max
 Freq:   60.0 Hz   min,  60.0 Hz   max
 Imp:        0 counted

NEU-GND A  (Channel 2)
 Rms:     1.1 Vrms min,   2.7 Vrms max
 Noise:   1.7 Vpk  min,   2.3 Vpk  max
 Imp:        0 counted

LNE-NEU B  (Channel 3)
 Rms:   111.4 Vrms min, 118.3 Vrms max
 Noise:   0.0 Vpk  min,  11.1 Vpk  max
 Freq:   60.0 Hz   min,  60.0 Hz   max
 Imp:        0 counted

NEU-GND B  (Channel 4)
 Rms:     0.1 Vrms min,   0.0 Vrms max
 Noise:   1.2 Vpk  min,   1.8 Vpk  max
 Imp:        0 counted
```

This is a summary strip chart report.

If you choose:

24 hr – strip charts will be printed every 24 hours at midnight.
12 hr – strip charts will be printed every 12 hours beginning at 12:00.
6 hr – strip charts will be printed every 6 hours beginning at 6:00.
3 hr – strip charts will be printed every 3 hours beginning at 3:00.
1 hr – strip charts will be printed every hour on the hour.
Off–no long-term summary information will be printed.

NOTE: Whatever strip chart interval you choose here will appear in the forthcoming questions.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the time interval between printing strip charts and summary reports.

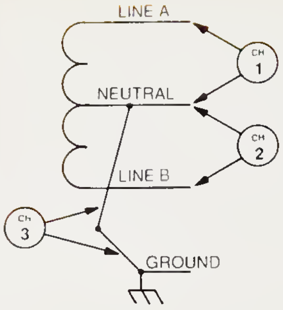
Possible selections are: 24 hours, 12 hours, 6 hours, 3 hours, 1 hour, or OFF. The interval that you choose impacts the choices offered you in the next series of questions.

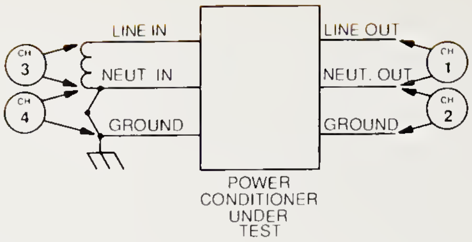
(Press HELP! for more information on selecting strip chart summary reports).

If you choose, for example, 12-hour strip chart summaries, your choices in the next questions regarding individual strip chart summary reports will include 12-hour strip charts. (If you choose 3-hour strip charts here, your choices in the next questions will include 3-hour strip charts, and so on.)

(Press HELP! for general information on the Setup Menu.)

Report Menu, continued

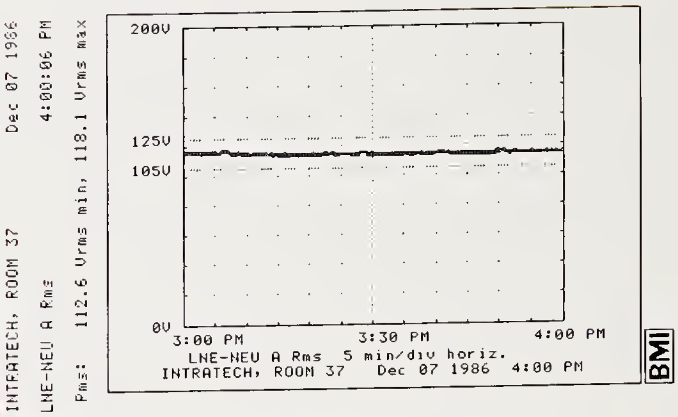




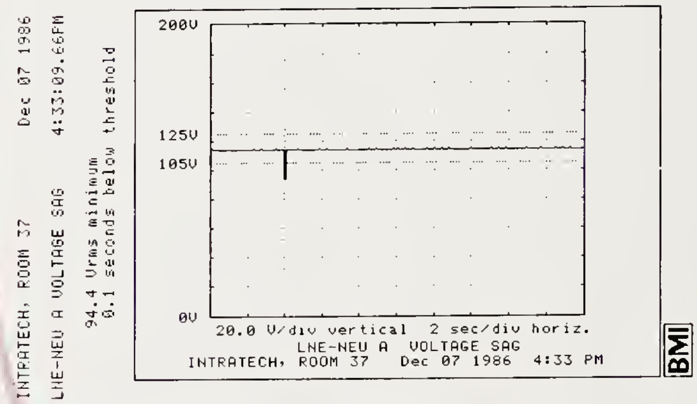
LINE-NEUT A Rms: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the line-to-neutral A Rms signal.


INTRATECH, ROOM 37 Dec 07 1986
LNE-NEU A Rms 4:00:06 PM
Rms: 112.6 Vrms min, 118.1 Vrms max

1-Hr strip chart: line-to-neutral A Rms.


INTRATECH, ROOM 37 Dec 07 1986
LNE-NEU A VOLTAGE SAG 4:33:09.66PM
94.4 Vrms minimum
0.1 seconds below threshold

Graph: line-to-neutral A Rms disturbance.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

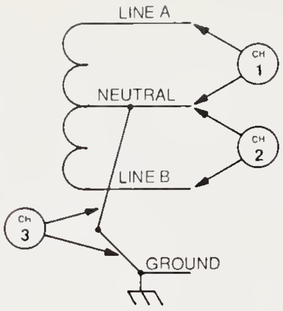
Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

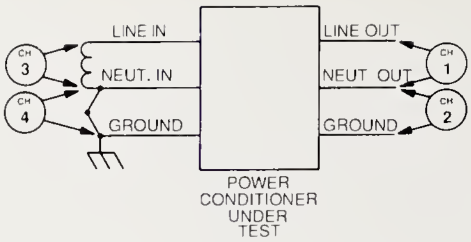
Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a disturbance graph of this
signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance graphs.

If you choose GRAPH, your PowerScope
will graph all disturbances for this
signal but will not print a strip
chart for this signal.

If you choose OFF, your PowerScope
will print neither disturbance graphs
nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu, you
will not have the choice of a strip
chart summary in this question.

(Press HELP! again for general infor-
mation on the Peport Menu.)
```

Report Menu, continued

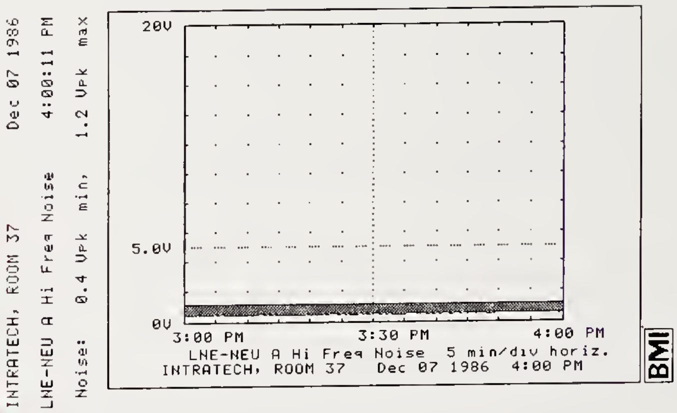




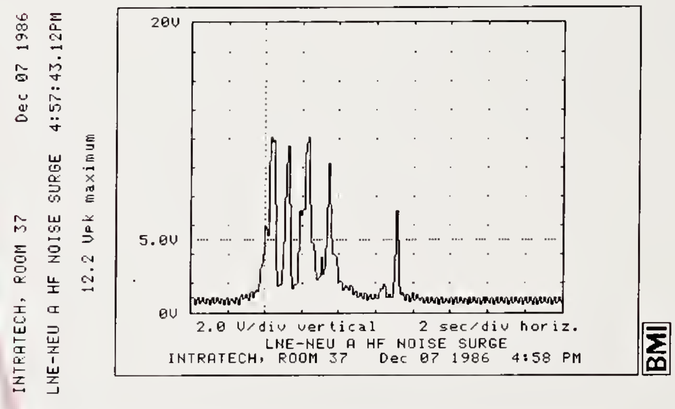
LINE-NEUT A HFN: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the high-frequency noise disturbances on line-to-neutral A.



1-Hr strip chart: line-to-neutral A high-frequency noise.



Graph: line-to-neutral A high-frequency noise.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

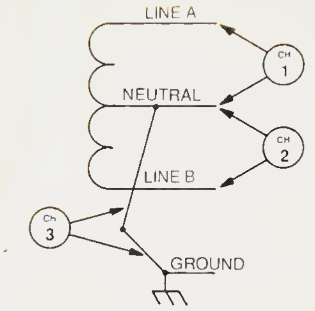
1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

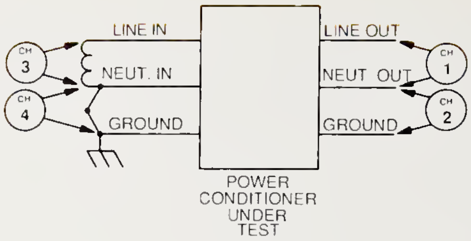
Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a disturbance graph of this
signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance graphs.

If you choose GRAPH, your PowerScope
will graph all disturbances for this
signal but will not print a strip
chart for this signal.

If you choose OFF, your PowerScope
will print neither disturbance graphs
nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu, you
will not have the choice of a strip
chart summary in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

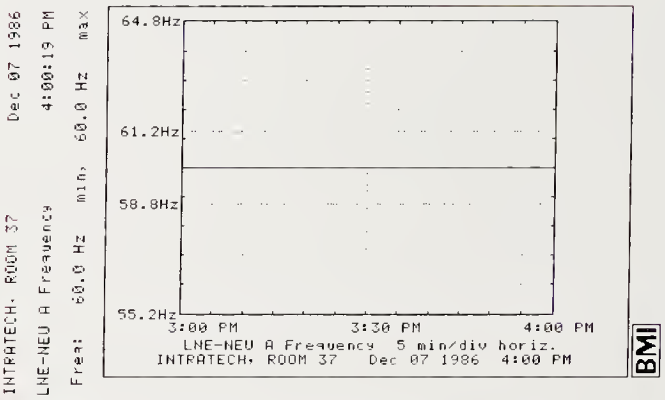




LINE-NEUT A Freq: Both

Selections: Both
1 Hr
Text
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the line-to-neutral A frequency signal.



1-Hr strip chart: line-to-neutral A frequency.

```
INTRATECH, ROOM 37          Dec 07 1986
LNE-NEU A LOW FREQ.     5:07:49.73PM
     Frequency below:        59.4 Hz


---------------------------------------
INTRATECH, ROOM 37          Dec 07 1986
LNE-NEU A LOW FREQ END  5:07:53.80PM
     Minimum frequency:      59.0Hz
```

Text report: line-to-neutral A frequency disturbance.

If you choose:

Both - your PowerScope will print both strip charts and text disturbance reports.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print text disturbance reports.

Text - your PowerScope will print text disturbance reports of this signal, but won't print strip charts.

Off - no text disturbance reports or strip charts will be printed for this signal, however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above, (3) TEXT, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a textual disturbance reports of this signal.

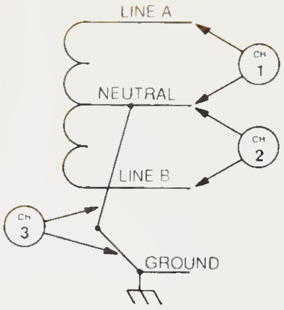
If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance reports.

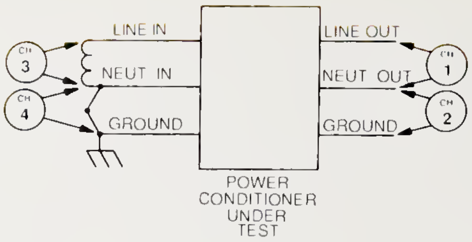
If you choose TEXT, your PowerScope will print a textual report of all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither textual reports nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of strip chart summaries in this question.

(Press HELP! again for general information on the Report Menu.)



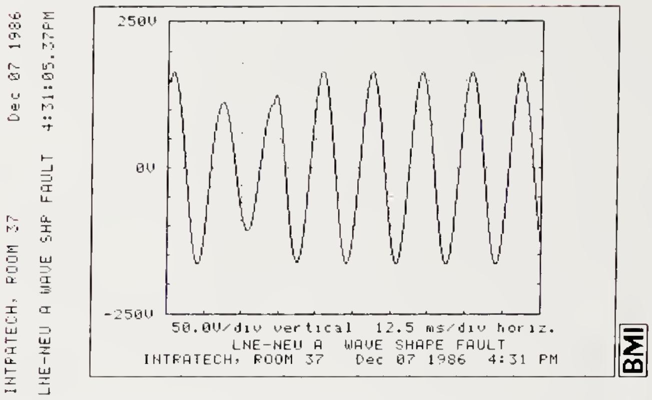


LINE-NEUT A Wave: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn line-to-neutral A waveshape fault graphs on or off.

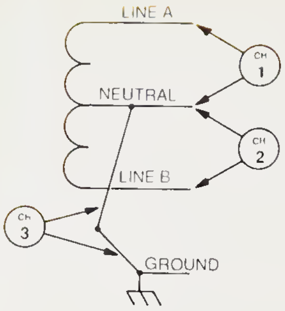
Generally, these graphs should be left on.

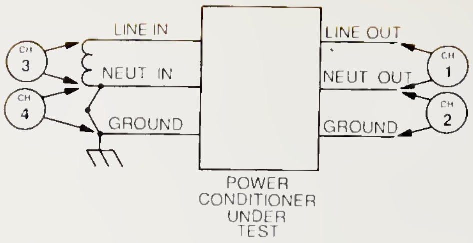


Line-to-neutral A waveshape fault graph.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
turn on or off the Waveshape fault
disturbance reporting for this signal.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

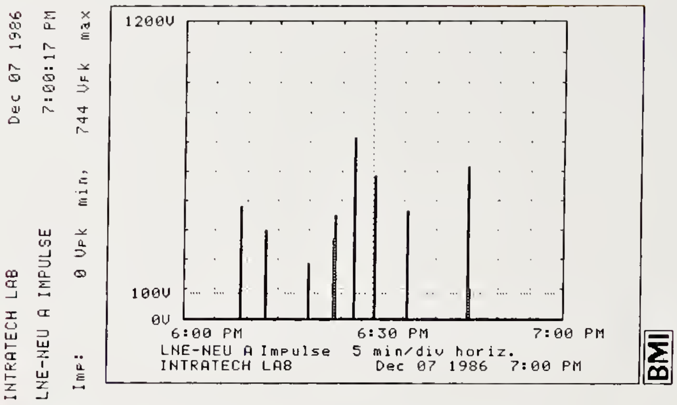




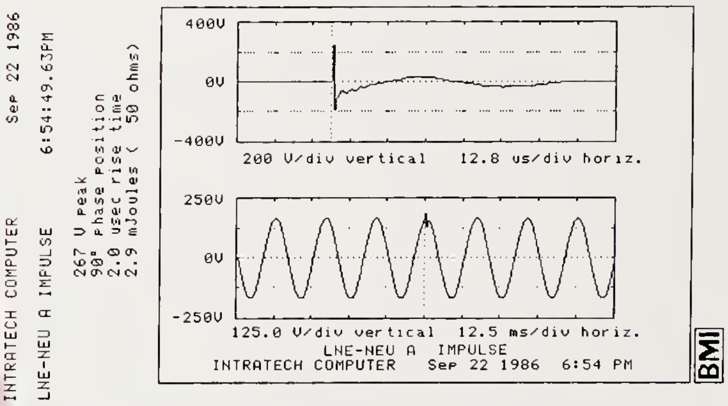
LINE-NEUT A Imp: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for line-to-neutral A impulses.



1-Hr strip chart: line-to-neutral A impulse.



Graph: line-to-neutral A impulse.

If you choose:

Both - your PowerScope will print both strip charts and disturbance graphs.

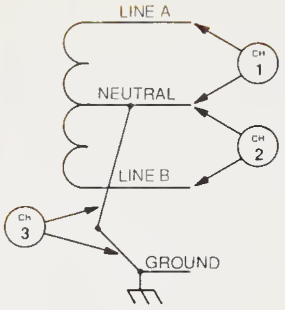
1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

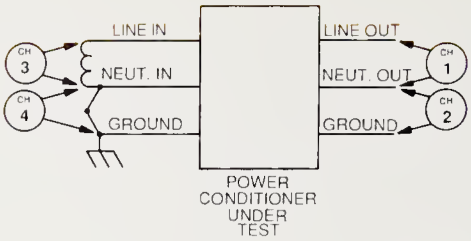
Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal, however the maximum reading of this signal will be reported textually in the summary reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a disturbance graph of this
signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance graphs.

If you choose GRAPH, your PowerScope
will graph all disturbances for this
signal but will not print a strip
chart for this signal.

If you choose OFF, your PowerScope
will print neither disturbance graphs
nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu, you
will not have the choice of a strip
chart summary in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

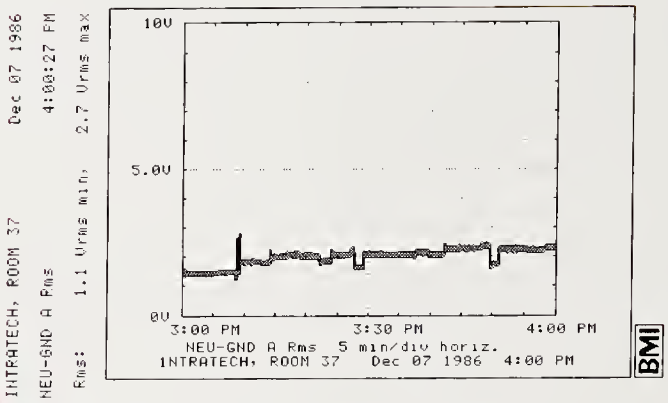




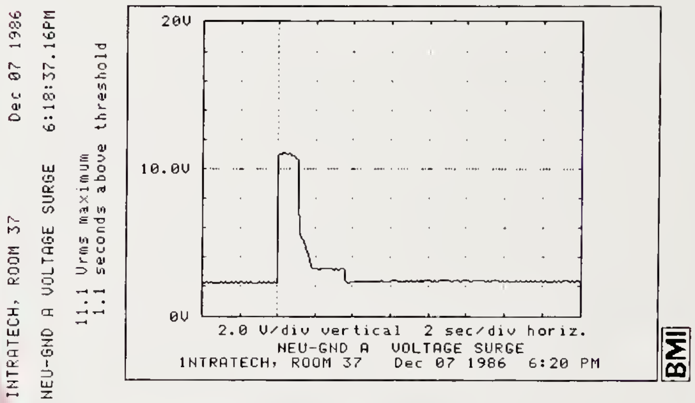
NEUT-GND A Rms: Both

Selections:Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the neutral-to-ground A Rms signal.



1-Hr strip chart: neutral-to-ground A Rms.



Graph: neutral-to-ground A surge.

If you choose:

Both - your PowerScope will print both strip charts and disturbance graphs.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no text disturbance reports or strip charts will be printed for this signal, however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

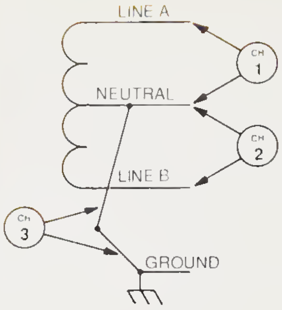
If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

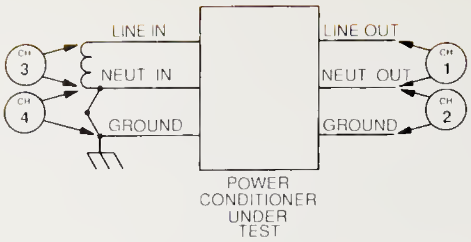
If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

(Press HELP! again for general information on the Report Menu.)

Report Menu, continued

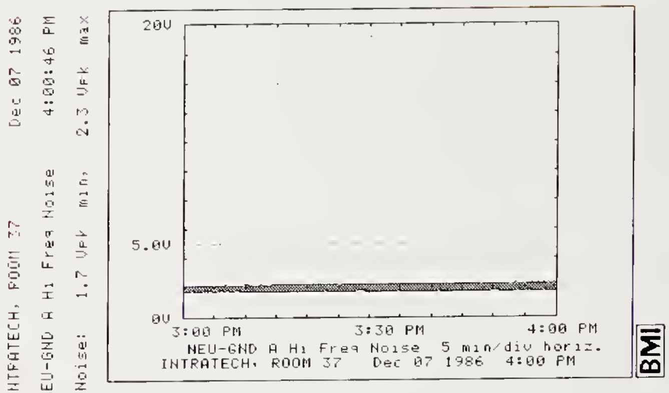




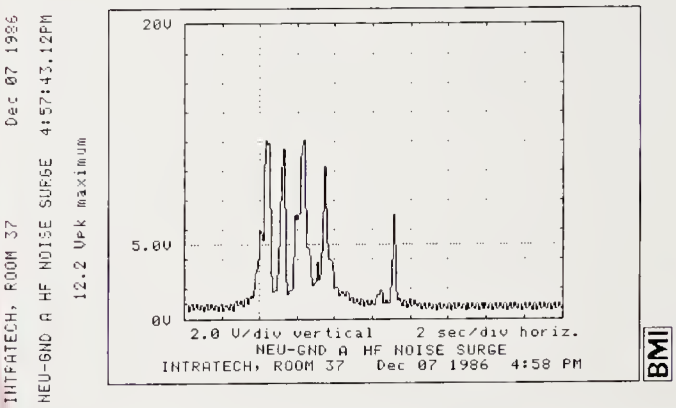
NEUT-GND A HFN: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the neutral-to-ground A high-frequency noise signal.



1-Hr strip chart: neutral-to-ground A high-frequency noise.



Graph: neutral-to-ground A high-frequency noise disturbance.

If you choose:

Both - your PowerScope will print both strip charts and disturbance graphs.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

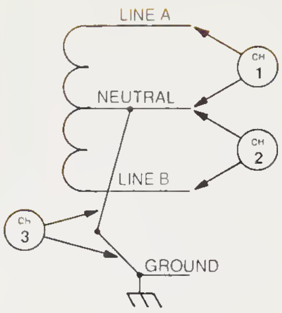
Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

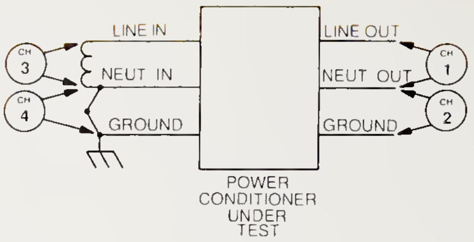
Off - no text disturbance reports or strip charts will be printed for this signal, however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a disturbance graph of this
signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance graphs.

If you choose GRAPH, your PowerScope
will graph all disturbances for this
signal but will not print a strip
chart for this signal.

If you choose OFF, your PowerScope
will print neither disturbance graphs
nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu, you
will not have the choice of a strip
chart summary in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

Report Menu, continued

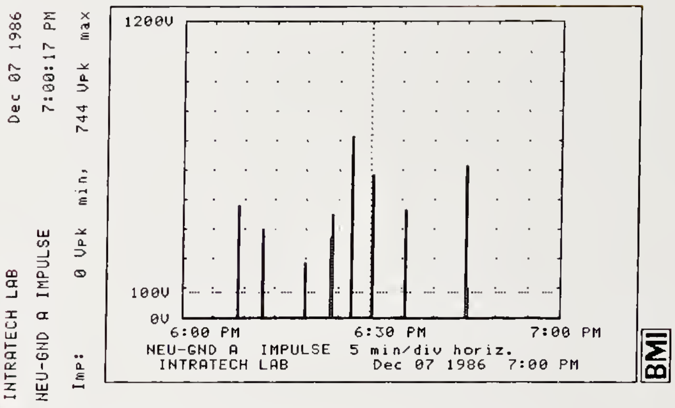




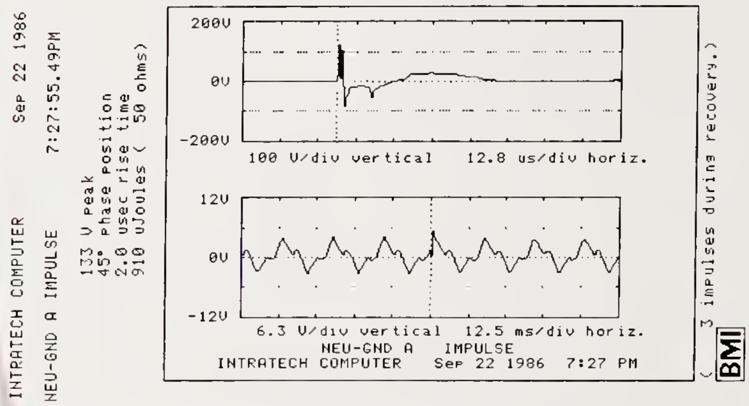
NEUT-GND A Imp: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to turn neutral-to-ground A impulse graphs on or off.



1-Hr strip chart: neutral-to-ground A impulse.



Graph: neutral-to-ground A impulse.

If you choose:

Both - your PowerScope will print both strip charts and disturbance graphs.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal, however the maximum reading of this signal will be reported textually in the summary reports.

The second half of the Report Menu (for phase B of dual-one phase power) is exactly the same as the first. Refer to pages 78 to 92 for an explanation of these menu items.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

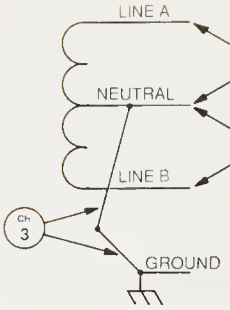
If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

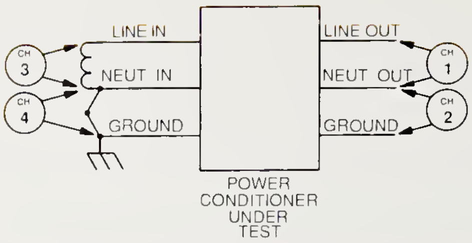
If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

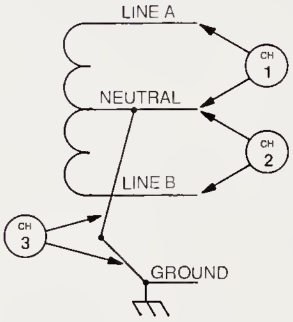
(Press HELP! again for general information on the Report Menu.)

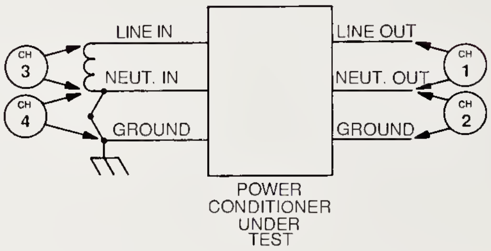




WARNING
You are working with high voltages that cause burns and lethal shocks. Connect the safety earth ground first. USE STANDARD SAFETY PRECAUTIONS.

Part 3 discusses how to connect your PowerScope for monitoring dual-one phase power.





Connecting to Dual-One Phase Power (for split phase)

To monitor all lines of dual-one phase power (line-to-neutral A, line-to-neutral B, and neutral-to-ground) requires three channels.

1. Using a green cable with green connector, connect ground into any one of the ground sockets. (The diagram shows ground plugged into the Channel 1 ground socket.)

2. Using a red cable, connect line A to Channel 1 red (positive).

3. Using a black cable, connect neutral first to a blue jumper cable, then into Channel 1 black (negative).

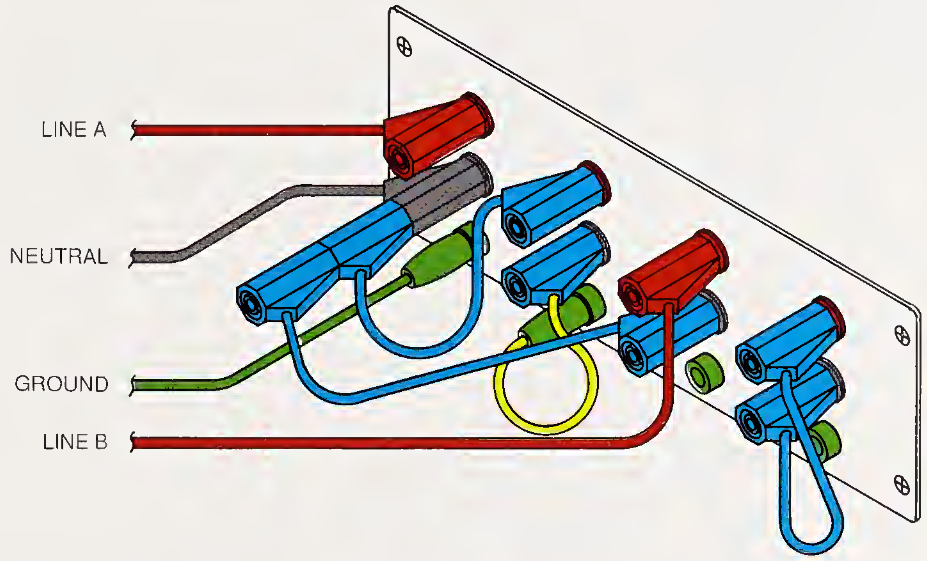
4. Connect the other end of the jumper into Channel 2 red (positive).

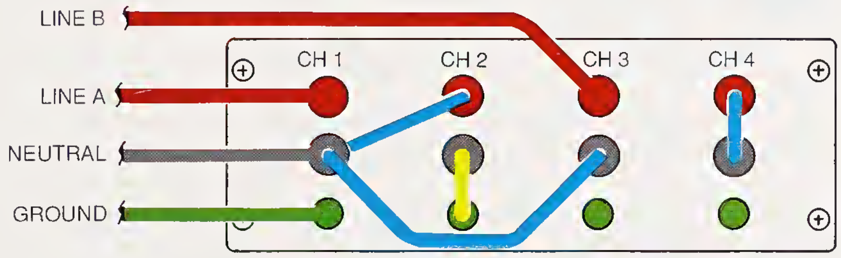
5. Using a blue jumper cable, connect Channel 2 black (negative) and Channel 2 green (ground).

6. Using a red cable, connect Line B to Channel 3 red (positive).

7. Using a blue jumper cable, connect Channel 2 red (positive) to Channel 3 negative (black).

8. Using a jumper cable, connect Channel 4 red (positive) to Channel 4 black (negative).



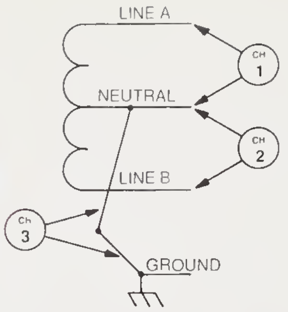


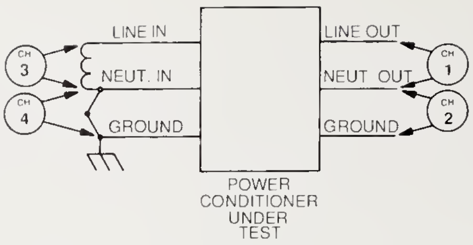
Press the STATUS key to get a printout verifying that your initial readings are within the thresholds that you've set.

```
INTRATECH                  Jan 09 1987

STATUS REPORT                  4:04 PM

LNE-NEU A (Channel 1)
   Voltage:      117.1 - 118.6 Vrms
   Frequency:     60.0 -  60.0 Hz
   Hi freq noise:  0.7 -   1.8 Vpk

NEU-GND A (Channel 2)
   Voltage:        0.6 -   0.7 Vrms
   Hi freq noise:  0.2 -   0.4 Vpk

LNE-NEU B (Channel 3)
   Voltage:      115.9 - 117.5 Vrms
   Frequency:     60.0 -  60.0 Hz
   Hi freq noise:  0.5 -   1.4 Vpk
 (Uncalibrated data.)

NEU-GND B (Channel 4)
   Voltage:        0.9 -   0.9 Vrms
   Hi freq noise:  1.8 -   2.0 Vpk

BATTERY CONDITION
   Voltage:    11.3 Vdc
   State:       Charged
```

Press the MONITOR key to begin monitoring.

Connecting To Dual-One Phase, continued





Connecting To Dual One-Phase (for analyzing a power conditioning device)

To monitor all signals from a power conditioning device requires 4 channels.

1. Using a green ground cable, connect ground to Channel 1 green (ground).

2. Using a red cable, connect line to Channel 1 red (positive).

3. Using a black cable, connect neutral to a blue jumper cable, then to Channel 1 black (negative).

4. Connect the other end of the blue jumper to Channel 2 red (positive).

Using a single-phase measuring cable plugged into the wall outlet:

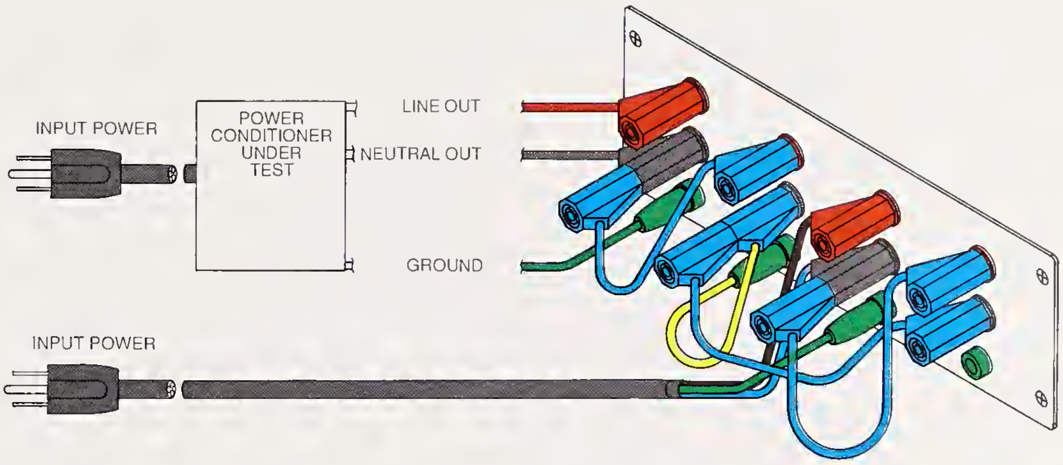
5. Connect the green ground connector on the measuring cable to Channel 3 green (ground).

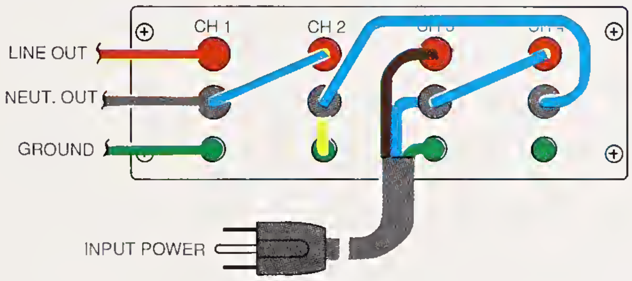
6. Connect the red connector to Channel 3 red (positive) and the black connector to a blue jumper, then into Channel 3 black (negative).

7. Connect the other end of the blue jumper into Channel 4 red (positive).

8. Using one blue jumper cable with yellow ground connector and one plain blue jumper cable, jumper from Channel 2 ground to Channel 2 black (negative) and from Channel 2 black (negative) to Channel 4 black (negative.)

WARNING
You are working with high voltages that cause burns and lethal shocks. Connect the safety earth ground first. USE STANDARD SAFETY PRECAUTIONS.





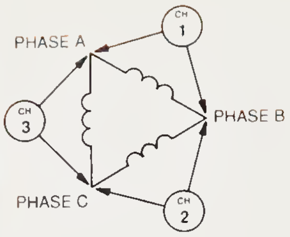
Press the STATUS key to get a printout verifying that you've connected correctly, and that your initial readings are within the thresholds you've set.

```
INTRATECH                    Jan 09 1987

STATUS REPORT                    4:04 PM

LNE-NEU A (Channel 1)
   Voltage:      117.1 - 118.6 Vrms
   Frequency:     60.0 -  60.0 Hz
   Hi freq noise:  0.7 -   1.8 Vpk

NEU-GND A (Channel 2)
   Voltage:        0.6 -   0.7 Vrms
   Hi freq noise:  0.2 -   0.4 Vpk

LNE-NEU B (Channel 3)
   Voltage:      115.9 - 117.5 Vrms
   Frequency:     60.0 -  60.0 Hz
   Hi freq noise:  0.5 -   1.4 Vpk
 (Uncalibrated data.)

NEU-GND B (Channel 4)
   Voltage:        0.9 -   0.9 Vrms
   Hi freq noise:  1.8 -   2.0 Vpk

BATTERY CONDITION
   Voltage:     11.3 Vdc
   State:         Charged
```

Press the MONITOR key to begin monitoring.

Three-Phase Delta

Part 1: Setup Menu



This chapter shows you how to set up the PowerScope for monitoring three-phase delta.

Quick Guide

1. **Press the SETUP MENU key.**

2. **Answer the questions in the menu using the VALUE UP/VALUE DOWN keys.**

3. **Press the down arrow key to go onto the next question.**

4. **Press the HELP! key if you want further explanation about the question or on what to do next.**

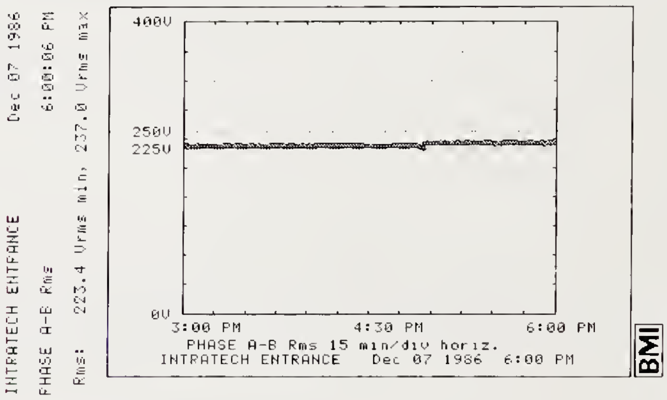
Press the SETUP MENU key now.

If you get the following message in the display, it's because the PowerScope has strip charts from the previous monitoring period.

Summary rpts: Print

Possible selections: Print
Clear

Use the VALUE UP/ VALUE DOWN keys to choose whether you want the pending strip charts.

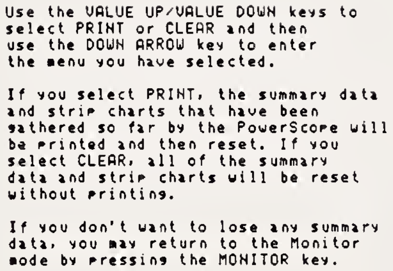


This is a summary strip chart.

If you want them printed then erased, position PRINT in the display, then press the down arrow. If you want them erased immediately, position CLEAR in the display, then press the down arrow.

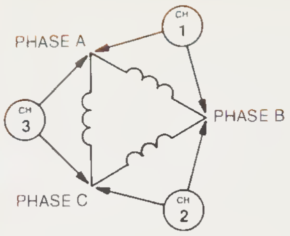
Then, press the SETUP MENU key again and proceed.

HELP!



```
Use the VALUE UP/VALUE DOWN keys to
select PRINT or CLEAR and then
use the DOWN ARROW key to enter
the menu you have selected.

If you select PRINT, the summary data
and strip charts that have been
gathered so far by the PowerScope will
be printed and then reset. If you
select CLEAR, all of the summary
data and strip charts will be reset
without printing.

If you don't want to lose any summary
data, you may return to the Monitor
mode by pressing the MONITOR key.
```

PROPERTY OF UNISYS
2276 HIGHCREST ROAD
ROSEVILLE, MN 5511

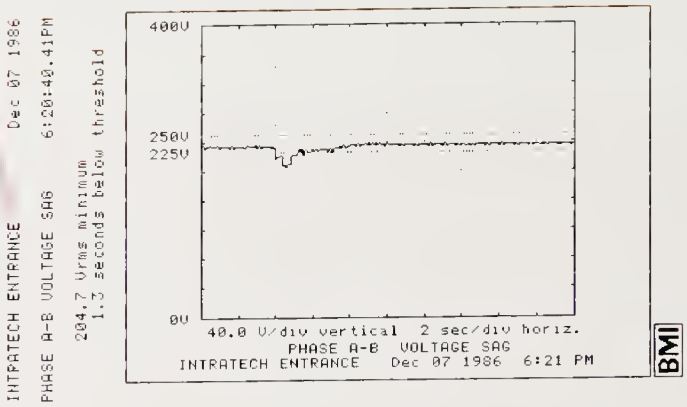


Site: INTRATECH ENTRANC

Use the number keys to enter the site you are monitoring.

The name can be up to 20 characters long.

Use the left arrow and right arrow keys to move the flashing cursor.



```
INTRATECH ENTRANCE            Dec 07 1986
PHASE A-B VOLTAGE SAG         6:20:40.41PM
204.7 Vrms minimum
  1.3 seconds below threshold
```

```
PHASE A-B  VOLTAGE SAG
INTRATECH ENTRANCE   Dec 07 1986   6:21 PM
```

Use the number keys to enter both letters and numbers; for example, to enter the letter “K”, press the 5JKL key 3 times. On the first press, a 5 will appear; on the second, a J will appear, and on the third, a K will appear.

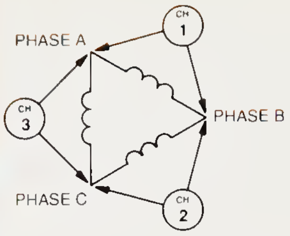
Now move the flashing cursor to the next position by pressing the right arrow key. Press the 0 SPACE button twice to enter a space. Press the down arrow key to go on to the next question.

HELP!

```
You may enter up to 20 characters from
the keyboard to identify the site
that you are monitoring.

Use the left and right arrow keys to
move the flashing cursor.

Use the number keys to enter both
letters and numbers.  For example,
to enter the letter 'B', push the
'2ABC' key three times.

(Press HELP! again for general
information on the Setup Menu.)
```

```
The Setup Menu contains questions that
define the operating parameters of
your PowerScope.   Specifically, it
asks you to name the monitoring site,
state what type of power each channel
will monitor, and specify thresholds
for each measurement.

The questions in the Setup Menu change
automatically depending on what type
of power you assign each channel and
if you have probes plugged into the
environmental channels.

(Press HELP! again for general infor-
mation on the operating sequence.)
```

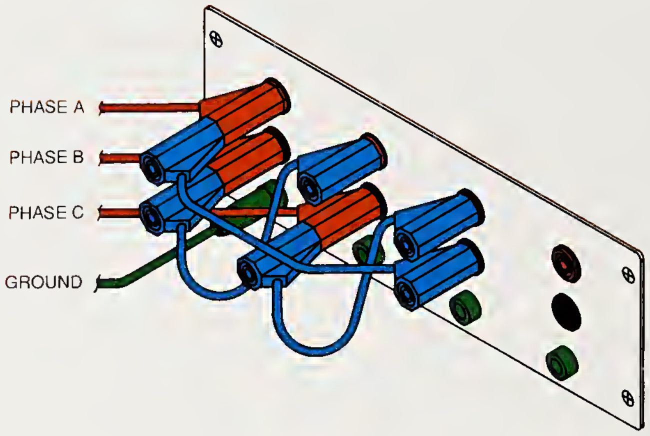
```
The usual sequence for operating
the PowerScope monitor is:

  1) Press the SETUP MENU key and
     answer the questions.
     To go on to the next question,
     press the Down Arrow.

  2) Connect the monitor to the
     power line. (See the HELP!
     message in the Setup Menu
     for the 'TYPE:' question.)

  3) Press the MONITOR key to monitor
     the power line.  Your reports
     will be printed automatically.

(Press HELP! again for general infor-
mation on the six modes of operation.)

=====================================

=====================================

The PowerScope monitor can be in one
of six modes:

   1) Press the SETUP MENU key to
      program the Setup Menu.
      Use the up arrow and the down
      arrow key to work your way
      through the questions on the
      menu. The 'HELP!' key will
      always give you information
      on a question on the menu.
      (You may want to press 'HELP!'
      when you have selected the type
      of power line you are going to
      monitor. This will give you
      installation instructions.)

      By pressing the SETUP MENU key,
      then immediately pressing the
      UP ARROW key, you will enter
      the Key Operator Menu.  This
      menu will give you control of
      the detailed operation of the
      PowerScope.

   2) Press the STATUS key to print
      the Status Report.  This
      report tells you the present
      voltage, frequency, and noise
      on each of the channels.  This
      report can be especially
      useful when you're trying to
      set the thresholds correctly.
      It's also useful for checking
      to see if you've installed the
      monitor correctly.

   3) Press the REPORT MENU key to
      enter the Report menu.  Use
      the up arrow and the down
      arrow to work your way through
      the questions on the menu.
      The 'HELP!' key will always
      give you information on a
      question on the menu.

   4) Press the MONITOR key to start
      monitoring the power line.
      The PowerScope will print a
      complete copy of your setup,
      and show you the initial wave-
      shapes on each channel (if you
      have requested them in the
      Report Menu).  Then it will
      print a disturbance report
      every time a power disturbance
      occurs.

   5) Press the SELF CALIBRATE key
      to calibrate your PowerScope.
      The PowerScope has the ability
      to completely calibrate itself.
      A Calibration Report will be
      printed automatically, showing
      the calibration of all of the
      ranges on all of the channels.

   6) Press the SELF TEST key to test
      the PowerScope.

 (There is no more HELP!)
```

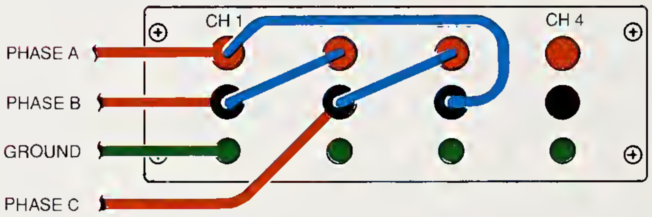


Type: 3-phase delta

Selections: Single Phase
Dual 1-phase
3 phase delta
3 phase wye
Ind. channels

Use the VALUE UP/ VALUE DOWN keys to select 3-phase delta power.





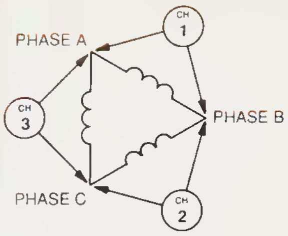
Press the HELP! key for information on connecting your PowerScope to Three-Phase Delta power, or see Part 3 of this chapter on page 132.

WARNING
You are working with high voltages that cause burns and lethal shocks. Connect the safety earth ground first. USE STANDARD SAFETY PRECAUTIONS.

HELP!

```
Select '3 phase delta' to monitor a
3-wire, 3-phase system commonly
found in industrial sites.

To install the PowerScope on a 3-
phase delta line, make the following
connections:

Channel 1 GREEN terminal: SAFETY
                          GROUND

Channel 1 Red terminal:   Phase A
Channel 1 Black terminal: Phase B

Channel 2 Red terminal:   Phase B
Channel 2 Black terminal: Phase C

Channel 3 Red terminal:   Phase C
Channel 3 Black terminal: Phase A

Channel 4 has no connections.

(Press HELP! again for general
information on the Setup Menu.)
```

Setup Menu, continued

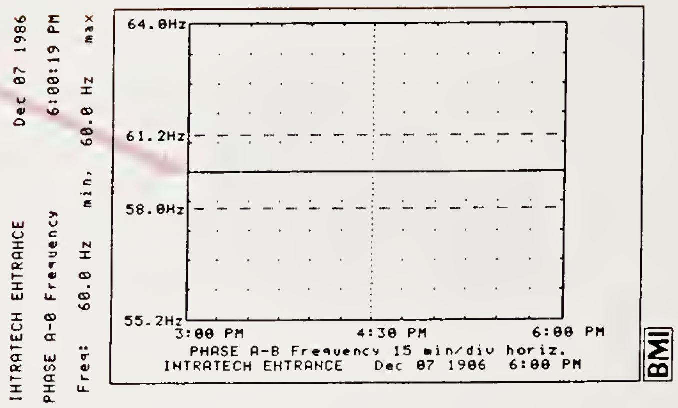


Nom. freq.: 60.0Hz

Range: 45 Hz to 400 Hz

Use the number keys to enter the nominal frequency of the line you are monitoring.

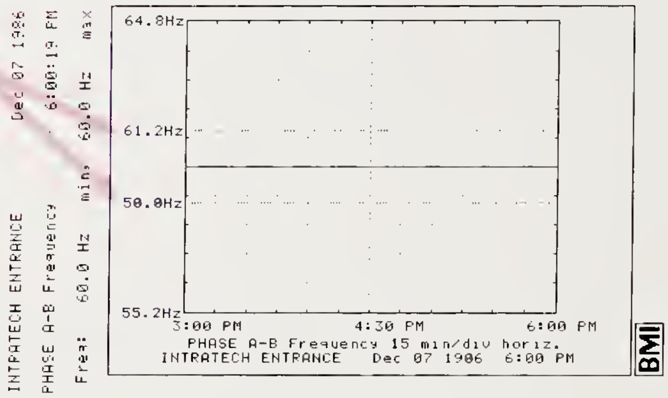
Typical settings are 50.0 Hz, 60.0 Hz, 400.0 Hz, or 415.0 Hz.



Freq. tol.: 1.2Hz

Use the number keys to enter a threshold for the line-frequency deviation.

The range is 1% to 30% of the nominal frequency, and is entered in Hertz. A typical value is 2% of the nominal frequency.



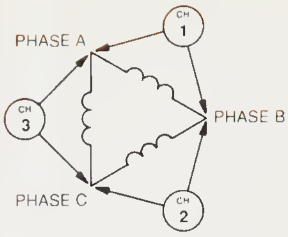
For example, if the nominal frequency setting is 50.0 Hz,
the frequency tolerance range is .5 Hz (1%) to 15 Hz (30%).
If the frequency is 60.0 Hz, the frequency tolerance range is .6 Hz to 18 Hz.
If the frequency is 400.0 Hz, the frequency tolerance range is 4.0 Hz to 120 Hz.
If the frequency is 415.0 Hz, the frequency tolerance range is 4.15 Hz to 124.5 Hz.

HELP!

```
Enter the nominal line frequency of
the line you are monitoring.  This
provides a reference to the monitor
from which it can base its measure-
ments. Typical values are 50.0 Hz,
60.0 Hz, and 400.0 Hz.  The
acceptable range is 45.0 Hz to
450.0 Hz.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

```
Enter in Hertz the amount of line
frequency deviation from nominal that
you are willing to tolerate before the
PowerScope reports a disturbance. The
range is 0.2% to 50% of your nominal
frequency setting.   A typical value
is 2% of your nominal frequency.

For example, if your nominal
frequency setting is 60 Hz., the range
is 0.1 Hz (0.2%) to 30.0 Hz (50%).
The default setting for 60 Hz is
1.2 Hz (2%).

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

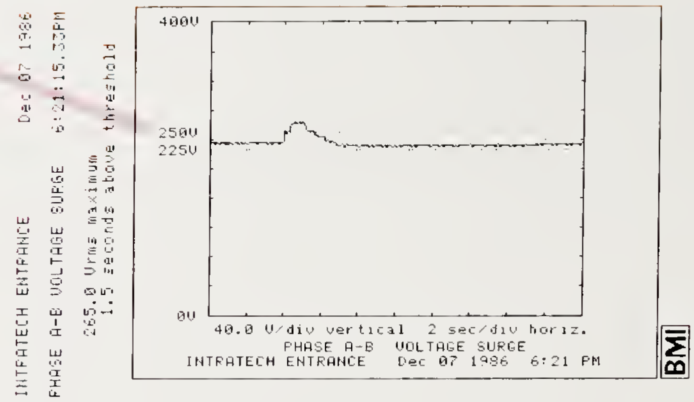
Setup Menu, continued



Surge volt: 250.0Vrms

Range: 1.0 Vrms to 600 Vrms

Use the number keys to enter the high-voltage threshold for all the phases on the three-phase delta power line you are monitoring.



The usual value is about 10% above the nominal voltage. The acceptable range is 1.0 Vrms to 600.0 Vrms. The surge voltage threshold also determines the full-scale RMS voltage as follows:

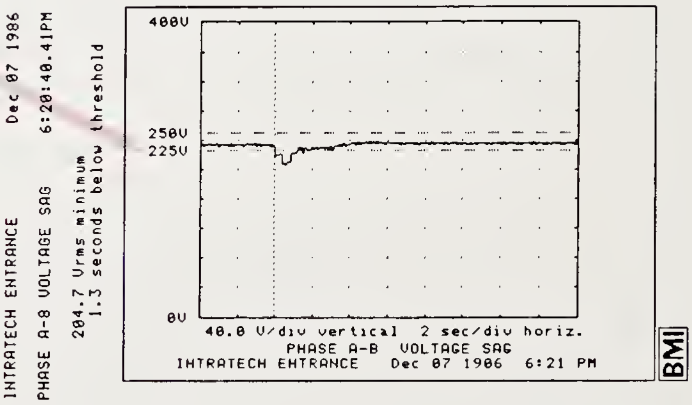
Voltage Surge Threshold Table

Surge Threshold	Full Scale
1.0 – 6.2 Vrms	10.0 Vrms
6.3 – 12.5 Vrms	20.0 Vrms
12.6 – 25.0 Vrms	40.0 Vrms
25.1 – 62.5 Vrms	100.0 Vrms
62.6 - 125.0 Vrms	200.0 Vrms
125.1 - 166.5 Vrms	250.0 Vrms
166.6 - 250.0 Vrms	400.0 Vrms
250.1 - 600.0 Vrms	800.0 Vrms

Sag volt: 225.0Vrms

Range: 0.0 Vrms to 599 Vrms

Use the number keys to enter the low-voltage threshold.

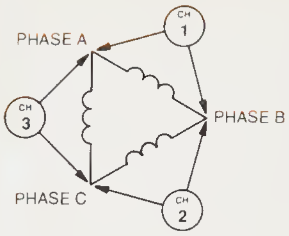


The usual value is about 15% below the nominal voltage. The acceptable range is 0.0 to 599.0 Vrms.

HELP!

```
Use the number keys to enter the
high voltage threshold.  The usual
value is about 10% above the nominal
voltage.  The acceptable range is
1.0 Vrms to 600.0 Vrms.

(Press HELP! again for general
information on the Setup Menu.)
```

```
Use the number keys to enter the low
voltage threshold.  The usual value is
about 15% below the nominal voltage.
The acceptable range is 0.0 Vrms to
599.9 Vrms.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

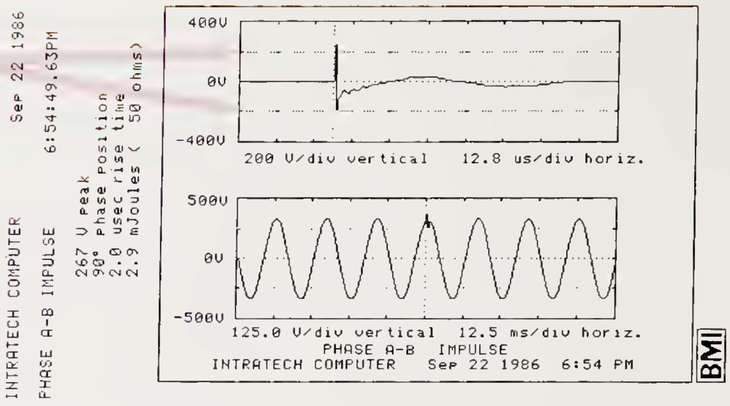


Impulse thr: 200 Vpk

Range: 20 Vpk to 6000 Vpk

Use the number keys to enter the value of the smallest impulse you wish the PowerScope to report.

Typical thresholds are in the range of 100-250 volts. You may select any value from 20 Vpk to 6000 Vpk.



```
INTRATECH COMPUTER      Sep 22 1986
PHASE A-B IMPULSE       6:54:49.63PM

   267 V peak
   90° phase position
   2.0 usec rise time
   2.9 mJoules ( 50 ohms)
```

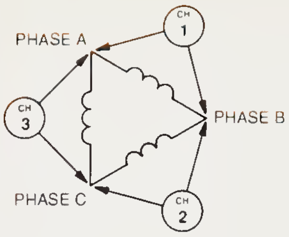
Phase A-to-B impulse graph.

HELP!

```
Use the number keys to enter the value
of the smallest impulse you wish the
PowerScope to report. Typical
thresholds are in the range of
100-250 volts.  You may select any
value from 20 to 6000 volts.

(Press HELP! again for more infor-
mation on answering this question.)
```

```
If you choose AUTO impulse ranging in
the Key Operator Menu, the PowerScope
will choose a full scale impulse range
according to the following table:

      Impulse              Impulse
     threshold            full scale
  -------------------     ----------
    20 Vpk -   50 Vpk       100 Vpk
    51 Vpk -  100 Vpk       200 Vpk
   101 Vpk -  200 Vpk       400 Vpk
   201 Vpk -  400 Vpk       800 Vpk
   401 Vpk -  800 Vpk      1600 Vpk
   801 Vpk - 1600 Vpk      3200 Vpk
  1601 Vpk - 6000 Vpk      6400 Vpk

However, if you choose MANUAL impulse
ranging in the Key Operator Menu, you
will be asked to select a full scale
range yourself.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued



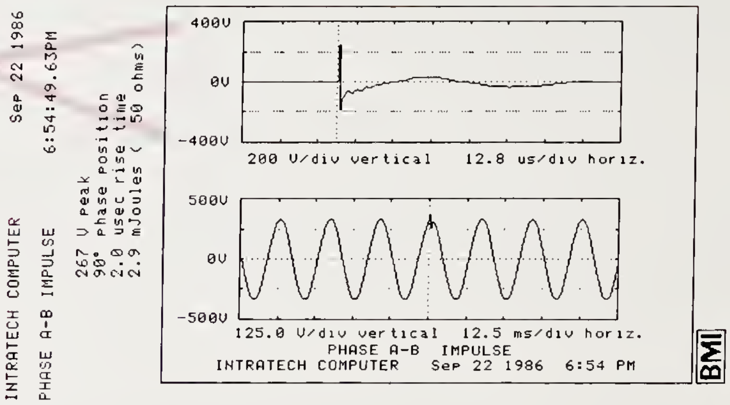
NOTE: The next question will only appear if you have Impulse Ranging in the Key Operator Menu set to MANUAL.

Imp. range: 400 Vpk

Possible selections: See the following table.

Use the VALUE UP/ VALUE DOWN keys to select the full-scale impulse range for phase A-to-B.

The selections depend on the impulse threshold, e.g. for a 20-24 Vpk threshold, there are 2 full-scale ranges available, 100 or 200 volts full scale.


INTRATECH COMPUTER Sep 22 1986
PHASE A-B IMPULSE 6:54:49.63PM
267 V peak
90° phase position
2.0 usec rise time
2.9 mJoules (50 ohms)

Phase A-to-B impulse graph.

Manual Impulse Ranging Table

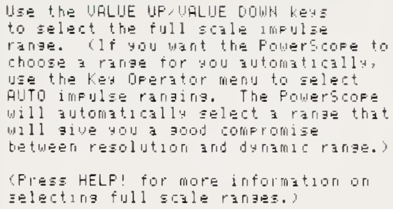
Impulse Threshold	Available Full-Scale Ranges
20-24 Vpk	+/- 100 or 200 volts full-scale
24-49 Vpk	+/- 100, 200 or 400 volts full-scale
50 Vpk	+/- 100, 200, 400 or 800 volts full-scale
51-99 Vpk	+/- 200, 400 or 800 volts full-scale
100 Vpk	+/- 200, 400, 800 or 1600 volts full-scale
101-199 Vpk	+/- 400, 800 or 1600 volts full-scale
200 Vpk	+/- 400, 800, 1600 or 3200 volts full-scale
201-399 Vpk	+/- 800, 1600 or 3200 volts full-scale
400 Vpk	+/- 800, 1600, 3200 or 6400 volts full-scale
401-800 Vpk	+/- 1600, 3200 or 6400 volts full-scale

If you selected AUTO Impulse Ranging in the Key Operator Menu (or plan to), the full-scale impulse range will be selected for you as follows:

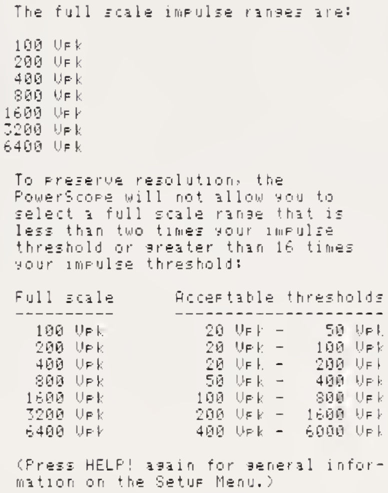
Automic Impulse Ranging Table

If Impulse Threshold selected in previous question is between...	The Impulse Range will set automatically to...
20 - 50 volts	+/- 100 volts
51 - 100 volts	+/- 200 volts
101 - 200 volts	+/- 400 volts
201 - 400 volts	+/- 800 volts
401 - 800 volts	+/- 1600 volts
801 - 1600 volts	+/- 3200 volts
1601- 6000 volts	+/- 6400 volts

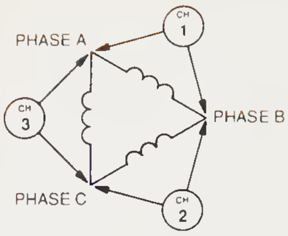
HELP!



```
Use the VALUE UP/VALUE DOWN keys
to select the full scale impulse
range.  (If you want the PowerScope to
choose a range for you automatically,
use the Key Operator menu to select
AUTO impulse ranging.  The PowerScope
will automatically select a range that
will give you a good compromise
between resolution and dynamic range.)

(Press HELP! for more information on
selecting full scale ranges.)
```



```
 The full scale impulse ranges are:

 100 Vpk
 200 Vpk
 400 Vpk
 800 Vpk
1600 Vpk
3200 Vpk
6400 Vpk

 To preserve resolution, the
 PowerScope will not allow you to
 select a full scale range that is
 less than two times your impulse
 threshold or greater than 16 times
 your impulse threshold:

 Full scale      Acceptable thresholds
 ----------      ---------------------
   100 Vpk          20 Vpk -    50 Vpk
   200 Vpk          20 Vpk -   100 Vpk
   400 Vpk          20 Vpk -   200 Vpk
   800 Vpk          50 Vpk -   400 Vpk
  1600 Vpk         100 Vpk -   800 Vpk
  3200 Vpk         200 Vpk -  1600 Vpk
  6400 Vpk         400 Vpk -  6000 Vpk

 (Press HELP! again for general infor-
 mation on the Setup Menu.)
```

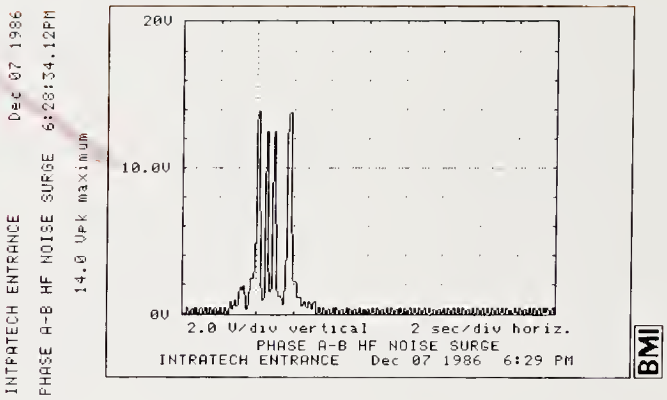


Hi. freq. noise: 10.0V

Range: 1.0V to 19.9V

Use the number keys to enter the high-frequency noise disturbance threshold (measured in peak-to-peak volts).

A typical threshold is 5.0 Vpk. The acceptable range is 1.0 Vpk to 19.9 Vpk.

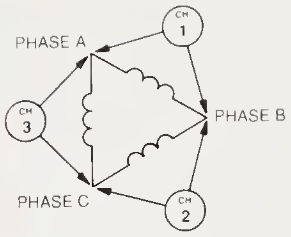


Phase A-B high frequency noise disturbance graph.

NOTE: If you are using probes for environmental monitoring there will be additional questions. See Chapter 6 (page 258) for an explanation of environmental thresholds.

HELP!

```
Use the number keys to enter the
high frequency noise disturbance
threshold (measured in peak-to-peak
volts).  A typical threshold is
5.0 Vpk.  The acceptable range is
1.0 Vpk to 19.9 Vpk.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```



The Report Menu lets you choose the graphs and summary reports your PowerScope prints. For a complete discussion of graphs and summary reports, see Appendix E.

Quick Guide

1. **Press the REPORT MENU key.**
2. **Use the VALUE UP/VALUE DOWN keys to answer the questions in the menu.**
3. **Press the down arrow to go to the next question.**
4. **Press the HELP! key if you want further explanation about the questions.**

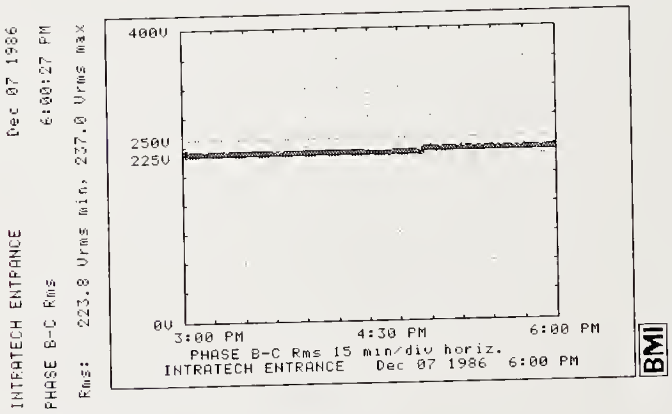
Press the REPORT MENU key now.

If you get the following message in the display, it's because the PowerScope has strip charts from the previous monitoring period.

Summary rpts: Print

Possible selections: Print
Clear

Use the VALUE UP/ VALUE DOWN keys to choose whether you want the pending strip charts.



This is a summary strip chart.

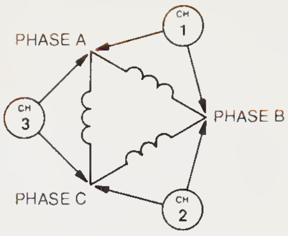
If you want them printed then erased, position PRINT in the display, then press the down arrow. If you want them erased immediately, position CLEAR in the display, then press the down arrow.

Then press the REPORT MENU key again and proceed.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select PRINT or CLEAR and then
use the DOWN ARROW key to enter
the menu you have selected.

If you select PRINT, the summary data
and strip charts that have been
gathered so far by the PowerScope will
be printed and then reset. If you
select CLEAR, all of the summary
data and strip charts will be reset
without printing.

If you don't want to lose any summary
data, you may return to the Monitor
mode by pressing the MONITOR key.
```

Report Menu, continued



Threshold report: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn the Threshold Report on or off.

Your PowerScope prints the Threshold Report after you press the MONITOR key. The Threshold Report shows all the current settings. Generally, you should leave this report on.

```
INTRATECH ENTRANCE          Dec 07 1986

THRESHOLD REPORT                2:57 PM

Type:       3-phase delta

PHASE-PHASE THRESHOLDS (Channels 1,2,3)
        Surge voltage:   250.0 Vrms
        Sag voltage:     225.0 Vrms
        Impulse:           200 Vpk
        High freq noise: 10.0 Vpk
        High frequency:  61.2 Hz
        Low  frequency:  58.8 Hz
        Wave shape:        20% variation
        Minimal duration: 0.1 cycles
        Line impedance:     50 ohms
        Hysteresis:       1.0%

SUMMARY REPORT INTERVAL:  3Hr

3 HOUR STRIP CHARTS
        PHASE A-B Rms Voltage
        PHASE A-B Hi Freq Noise
        PHASE A-B Frequency
        PHASE B-C Rms Voltage
        PHASE B-C Hi Freq Noise
        PHASE B-C Frequency
        PHASE C-A Rms Voltage
        PHASE C-A Hi Freq Noise
        PHASE C-A Frequency

Internal UPS time:   5 minutes.
```

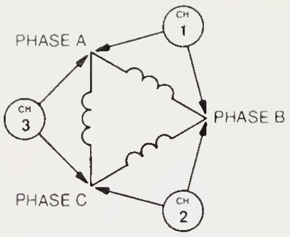
HELP!

```
Use the VALUE UP/VALUE DOWN keys to
turn the Threshold Report on or off.
This report should normally be left
on.

(Press HELP! again for more infor-
mation on Threshold Reports).

======================================

======================================

The usual sequence for operating
the PowerScope monitor is:

  1) Press the SETUP MENU key and
     answer the questions.
     To go on to the next question,
     press the Down Arrow.

  2) Connect the monitor to the
     power line. (See the HELP!
     message in the Setup Menu
     for the 'TYPE:' question.)

  3) Press the MONITOR key to monitor
     the power line.  Your reports
     will be printed automatically.

(Press HELP! again for general infor-
mation on the six modes of operation.)
```

```
The Threshold Report is the list of
thresholds and settings your
PowerScope can print automatically
before it begins monitoring.

(If you turn the Threshold Report
on now, you can still omit it when
you begin monitoring by pressing
the MONITOR key followed immediately
by the UP ARROW key.)

(Press HELP! again for general infor-
mation on the Report Menu).

 ======================================

 ======================================

The PowerScope monitor can be in one
of six modes:

     1) Press the SETUP MENU key to
        program the Setup Menu.
        Use the up arrow and the down
        arrow key to work your way
        through the questions on the
        menu. The 'HELP!' key will
        always give you information
        on a question on the menu.
        (You may want to press 'HELP!'
        when you have selected the type
        of power line you are going to
        monitor. This will give you
        installation instructions.)

        By pressing the SETUP MENU key,
        then immediately pressing the
        UP ARROW key, you will enter
        the Key Operator Menu.  This
        menu will give you control of
        the detailed operation of the
        PowerScope.

     2) Press the STATUS key to print
        the Status Report.  This
        report tells you the present
        voltage, frequency, and noise
        on each of the channels.  This
        report can be especially
        useful when you're trying to
        set the thresholds correctly.
        It's also useful for checking
        to see if you've installed the
        monitor correctly.

     3) Press the REPORT MENU key to
        enter the Report menu.  Use
        the up arrow and the down
        arrow to work your way through
        the questions on the menu.
        The 'HELP!' key will always
        give you information on a
        question on the menu.

     4) Press the MONITOR key to start
        monitoring the power line.
        The PowerScope will print a
        complete copy of your setup,
        and show you the initial wave-
        shapes on each channel (if you
        have requested them in the
        Report Menu).  Then it will
        print a disturbance report
        every time a power disturbance
        occurs.

     5) Press the SELF CALIBRATE key
        to calibrate your PowerScope.
        The PowerScope has the ability
        to completely calibrate itself.
        A Calibration Report will be
        printed automatically, showing
        the calibration of all of the
        ranges on all of the channels.

     6) Press the SELF TEST key to test
        the PowerScope.

(There is no more HELP!)
```

```
The Report Menu contains questions
that define the type of summary strip
charts you would like, and over what
time duration you would like them.

The questions in the Report Menu
vary depending on the type of power
each channel is monitoring, and if
you have probes plugged into the
environmental channels.

(Press HELP! again for general
information on the operating
sequence.
```

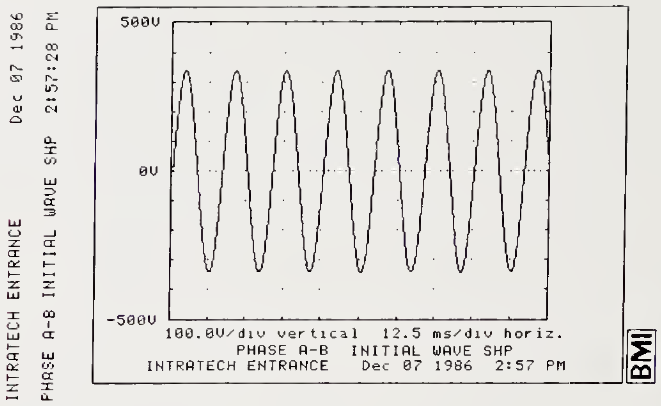
Report Menu, continued



Initial waves: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn the initial waveshape graphs on or off.


INTRATECH ENTRANCE Dec 07 1986
PHASE A-B INITIAL WAVE SHP 2:57:28 PM

100.0V/div vertical 12.5 ms/div horiz.
PHASE A-B INITIAL WAVE SHP
INTRATECH ENTRANCE Dec 07 1986 2:57 PM

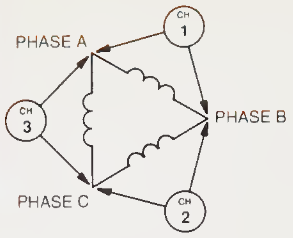
Your PowerScope prints initial waveshape graphs after the Threshold Report. These graphs show the initial condition of the sine waves. Generally, you should leave this report on.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
turn the Initial Waveshape Report on
or off. This report should normally
be left on.

(Press HELP! again for more infor-
mation on the Initial Waveshape
Report).
```

```
The Initial Waveshape Report shows the
condition of the sine waves at the
beginning of the monitoring session.
Initial waveshapes may give you
additional information on the
condition of the power lines.

(Press HELP! again for general infor-
mation on the Report Menu).
```

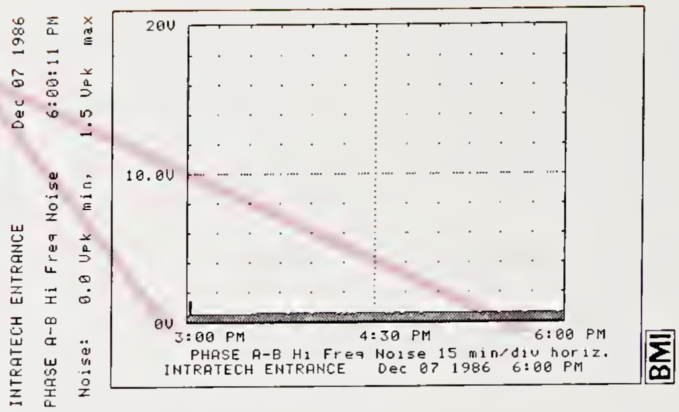
Report Menu, continued



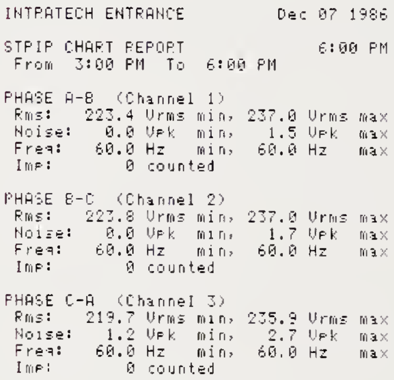
Strip charts: 3 Hr

Selections: 24 Hr
12 Hr
6 Hr
3 Hr
1 Hr
Off

Use the VALUE UP/ VALUE DOWN keys to select the strip chart interval.



Phase A-to-B 3-Hr strip chart.



```
INTPATECH ENTRANCE          Dec 07 1986

STPIP CHART PEPOPT              6:00 PM
 From  3:00 PM  To  6:00 PM

PHASE A-B  (Channel 1)
 Rms:   223.4 Vrms min, 237.0 Vrms max
 Noise:   0.0 Vpk  min,   1.5 Vpk  max
 Freq:   60.0 Hz   min,  60.0 Hz   max
 Imp:         0 counted

PHASE B-C  (Channel 2)
 Rms:   223.8 Vrms min, 237.0 Vrms max
 Noise:   0.0 Vpk  min,   1.7 Vpk  max
 Freq:   60.0 Hz   min,  60.0 Hz   max
 Imp:         0 counted

PHASE C-A  (Channel 3)
 Rms:   219.7 Vrms min, 235.9 Vrms max
 Noise:   1.2 Vpk  min,   2.7 Vpk  max
 Freq:   60.0 Hz   min,  60.0 Hz   max
 Imp:         0 counted
```

Strip chart summary for three-phase wye monitoring session.

If you choose:

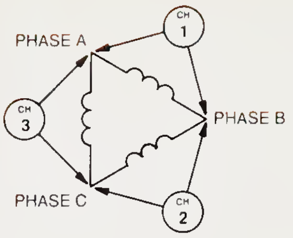
24 hr – strip charts will be printed every 24 hours at midnight.
12 hr – strip charts will be printed every 12 hours beginning at 12:00.
6 hr – strip charts will be printed every 6 hours beginning at 6:00.
3 hr – strip charts will be printed every 3 hours beginning at 3:00.
1 hr – strip charts will be printed every hour on the hour.
Off – no long-term summary information will be printed.

NOTE: Whatever strip chart interval you choose here will appear in the forthcoming questions.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the time interval between
printing strip charts and summary
reports.

Possible selections are: 24 hours,
12 hours, 6 hours, 3 hours, 1 hour,
or OFF.  The interval that you choose
impacts the choices offered you in the
next series of questions.

(Press HELP! for more information on
selecting strip chart summary
reports).
```

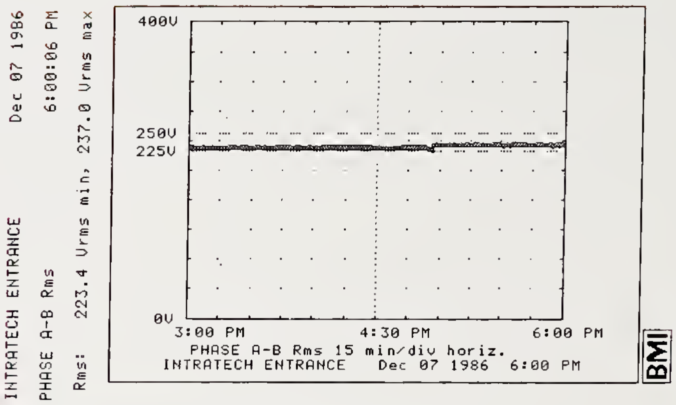
```
If you choose, for example, 12-hour
strip chart summaries, your choices
in the next questions regarding
individual strip chart summary reports
will include 12-hour strip charts.
(If you choose 3-hour strip charts
here, your choices in the next
questions will include 3-hour strip
charts, and so on.)

(Press HELP! for general information
on the Setup Menu.)
```



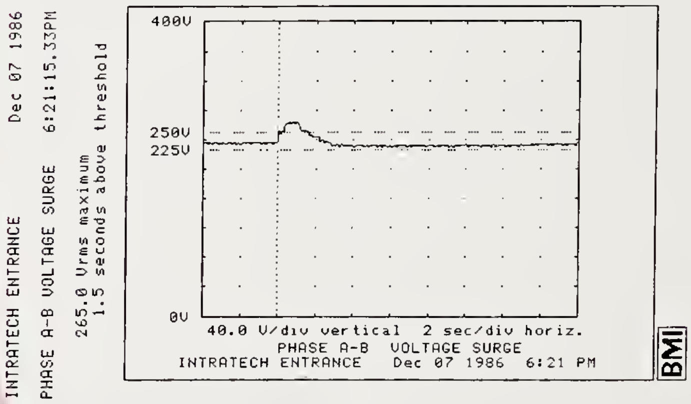
Phase A-B Rms: Both

Selections: Both
3 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting you want for the Rms signal on the A-to-B phase.



3-Hr strip chart: phase A-to-B Rms.



Graph: phase A-to-B surge.

If you choose :

3-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Both - your PowerScope will print both strip charts and graphs.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

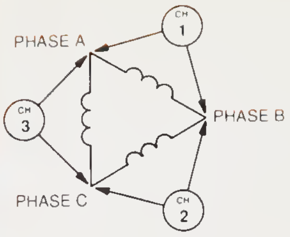
If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

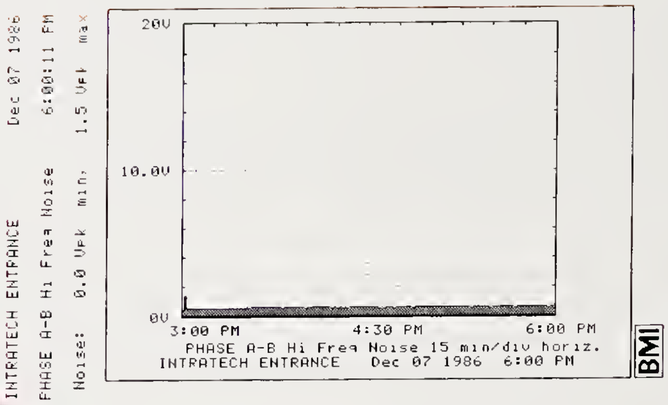
(Press HELP! again for general information on the Report Menu.)



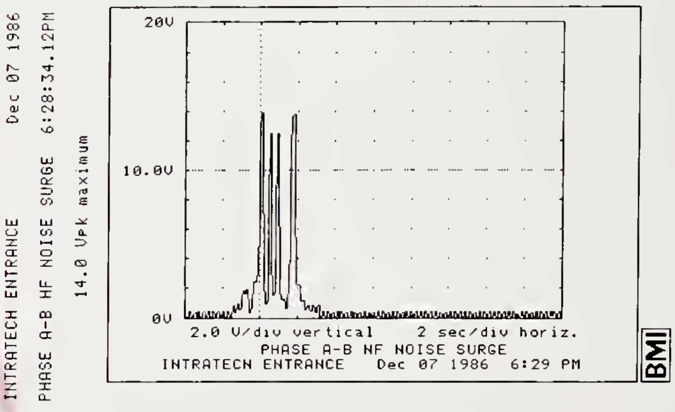
Phase A-B HFN: Both

Selections: Both
3 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the high-frequency noise disturbances on phase A-to-B.



3-Hr strip chart: phase A-to-B high-frequency noise.



Graph: phase A-to-B high-frequency noise.

If you choose :

3-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Both - your PowerScope will print both strip charts and graphs.

Off - no text disturbance reports or strip charts will be printed for this signal, however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

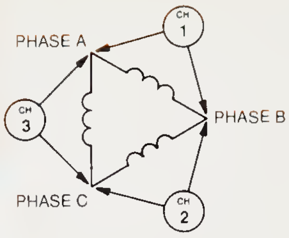
If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

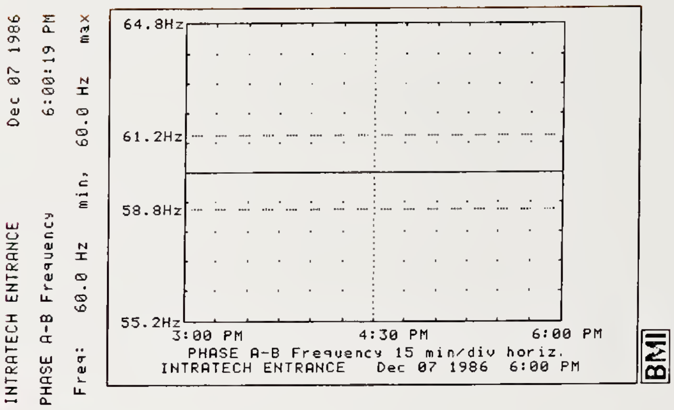
(Press HELP! again for general information on the Report Menu.)



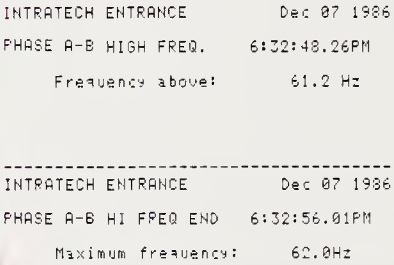
Phase A-B Freq: Both

Selections: Both
3 Hr
Text
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the phase A-to-B frequency signal.



3-Hr strip chart: phase A-to-B frequency.



```
INTRATECH ENTRANCE         Dec 07 1986
PHASE A-B HIGH FREQ.     6:32:48.26PM
     Frequency above:        61.2 Hz


---------------------------------------
INTRATECH ENTRANCE         Dec 07 1986
PHASE A-B HI FREQ END    6:32:56.01PM
     Maximum frequency:      62.0Hz
```

Text report: phase A-to-B frequency disturbance.

If you choose :

Both - your PowerScope will print both strip charts and text reports.

3-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance text reports.

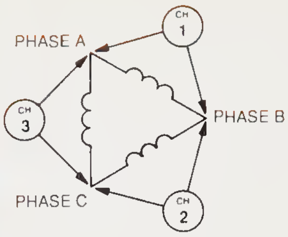
Text - your PowerScope will print disturbance text reports of this signal, but won't print strip charts.

Off - no disturbance text reports or strip charts will be printed for this signal, however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above, (3) TEXT, and (4)
OFF.

If you select BOTH, your PowerScope
will print both a strip chart
summary and a textual disturbance
reports of this signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance reports.

If you choose TEXT, your PowerScope
will print a textual report of all
disturbances for this signal but
will not print a strip chart for
this signal.

If you choose OFF, your PowerScope
will print neither textual reports
 nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu,
you will not have the choice of
strip chart summaries in this
question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

Report Menu, continued

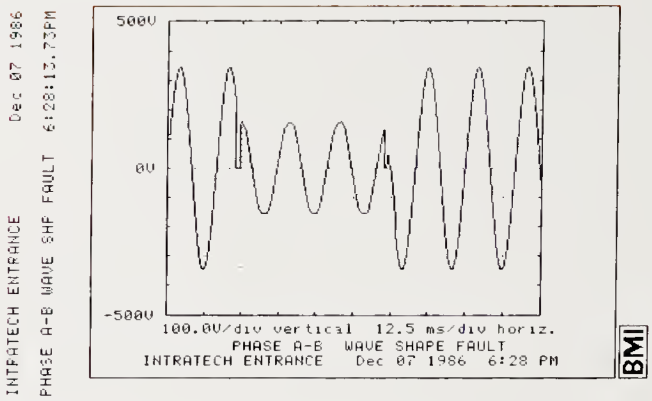


PHASE A-B Wave: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn phase A-to-B waveshape fault graphs on or off.

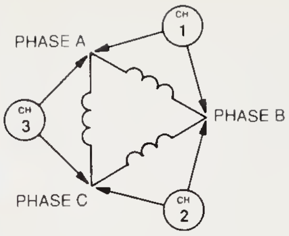
Generally, you will leave these graphs on.



Phase A-to-B waveshape fault graph.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
turn on or off the Waveshape fault
disturbance reporting for this signal.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

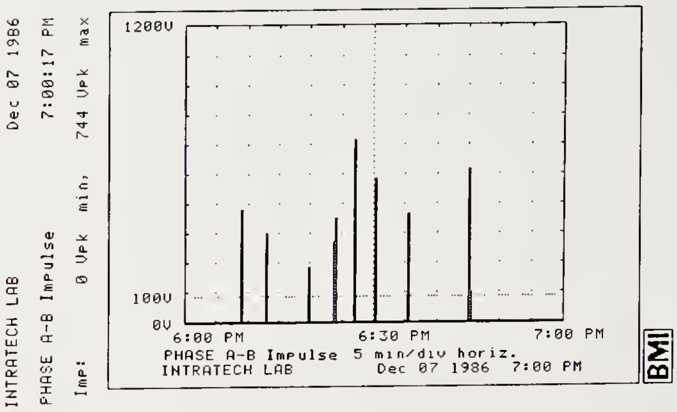


Report Menu, continued

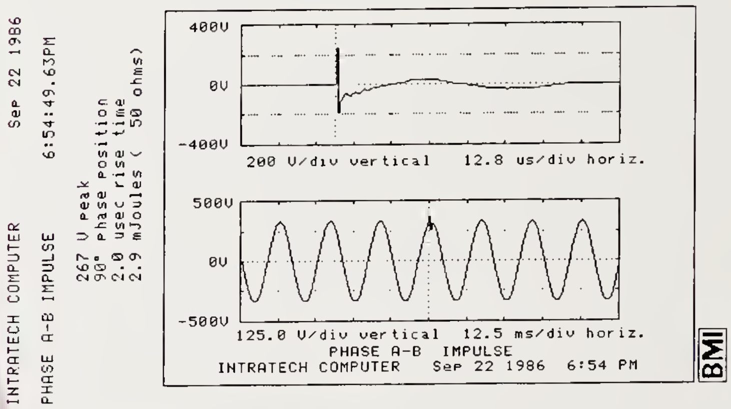
Phase A-B Imp: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for impulses on phase A-to-B.



1-Hr strip chart: phase A-to-B impulse.



Graph: phase A-to-B impulse.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the maximum reading of this signal will be reported textually in the summary reports.

The remaining two sections of the Report Menu (for phase B-to-C and phase C-to-A of three-phase delta power) are exactly the same as the first section. Refer to pages 122 to 130 for an explanation of these menu items.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

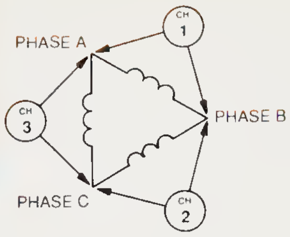
If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

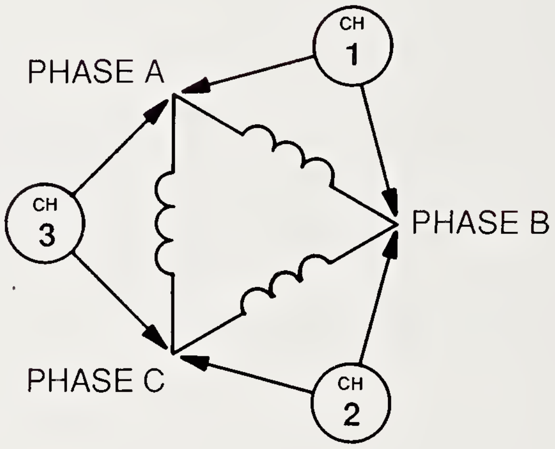
If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

(Press HELP! again for general information on the Report Menu.)



Part 3: Connecting To Three-Phase Delta

Part 3 discusses how to connect your PowerScope to monitor three-phase delta power.



You need three channels to measure all lines in three-phase delta power (line A-to-line B, line B-to-line C, and line C-to-line A).

1. Using a red cable, connect line A to a blue jumper cable, then into Channel 1 red (positive).

2. Connect the other end of the jumper cable to Channel 3 black (negative).

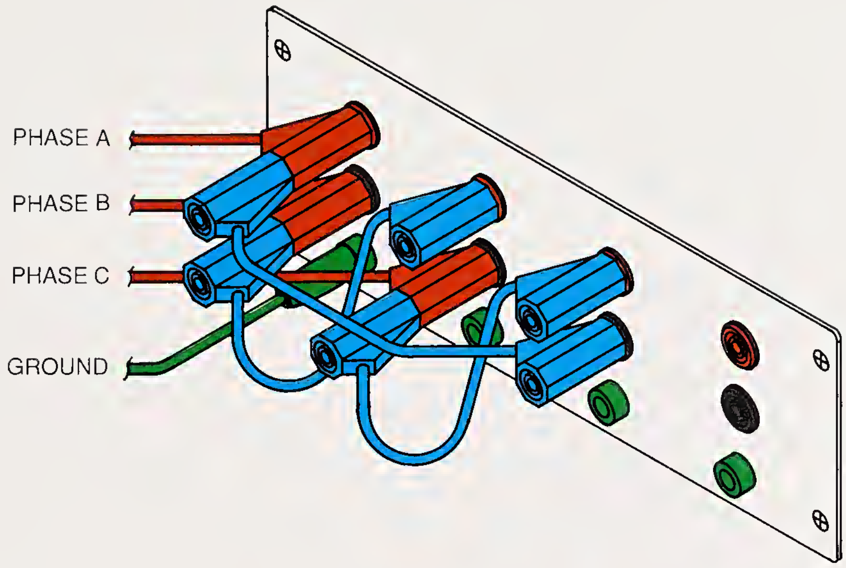
3. Using a red cable, connect line B to a blue jumper cable, then into Channel 1 black (negative).

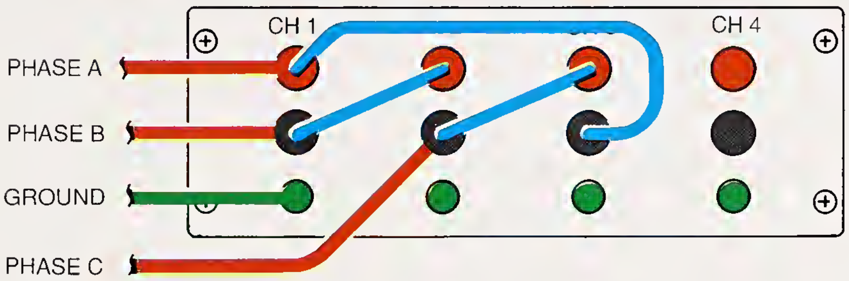
4. Connect the other end of the jumper cable into Channel 2 red (positive).

5. Using a red cable, connect line C to a blue jumper cable, then into Channel 2 black (negative).

6. Connect the other end of the jumper cable to Channel 3 red (positive).

WARNING
You are working with high voltages that cause burns and lethal shocks. Connect the safety earth ground first. USE STANDARD SAFETY PRECAUTIONS.





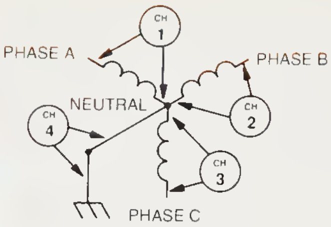
Press the STATUS key to get a printout verifying that you've connected correctly, and that your initial readings are within the thresholds that you've set.

```
INTRATECH ENTRANCE         Dec 07 1986

STATUS REPORT                  6:31 PM

PHASE A-B (Channel 1)
   Voltage:       234.2 - 237.1 Vrms
   Frequency:      60.0 -  60.0 Hz
   Hi freq noise:  0.0 -   0.8 Vpk

PHASE B-C (Channel 2)
   Voltage:       234.7 - 237.0 Vrms
   Frequency:      60.0 -  60.0 Hz
   Hi freq noise:  0.2 -   1.6 Vpk

PHASE C-A (Channel 3)
   Voltage:       234.5 - 236.5 Vrms
   Frequency:      60.0 -  60.0 Hz
   Hi freq noise:  1.5 -   2.7 Vpk

BATTERY CONDITION
   Voltage:     11.1 Vdc
   State:        Charged
```

Press the MONITOR key to begin monitoring.

Three-Phase Wye

Part 1: The Setup Menu



This chapter shows you how to set up the PowerScope if you want to monitor three-phase wye power.

Quick Guide

1. **Press the SETUP MENU key.**

2. **Answer the questions in the menu using the VALUE UP/VALUE DOWN keys or the number keypad.**

3. **Press the down arrow key to go onto the next question.**

4. **Press the HELP! key if you want further explanation about the question or on what to do next.**

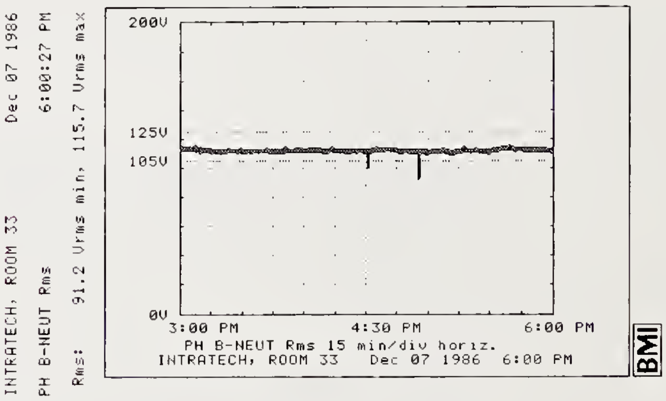
Press the SETUP MENU key now.

If you get the following message in the display, it's because the PowerScope has strip charts from the previous monitoring period.

Summary rpts: Print

Possible selections: Print
Clear

Use the VALUE UP/ VALUE DOWN keys to choose whether you want the pending strip charts.



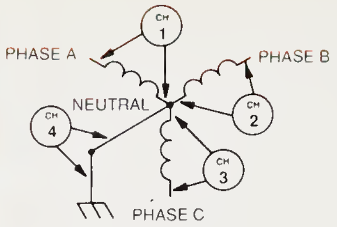
This is a summary strip chart.

If you want them printed then erased, position PRINT in the display, then press the down arrow. If you want them erased immediately, position CLEAR in the display, then press the down arrow.

Then, press the SETUP MENU key again and proceed.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select PRINT or CLEAR and then
use the DOWN ARROW key to enter
the menu you have selected.

If you select PRINT, the summary data
and strip charts that have been
gathered so far by the PowerScope will
be printed and then reset. If you
select CLEAR, all of the summary
data and strip charts will be reset
without printing.

If you don't want to lose any summary
data, you may return to the Monitor
mode by pressing the MONITOR key.
```

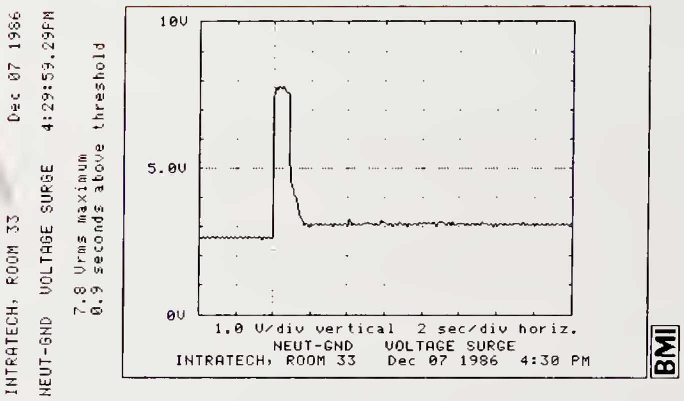


Site: INTRATECH, ROOM 3

Use the number keys to enter the name of the site where you will be monitoring the power.

The name can be up to 20 characters long.

Use the left arrow and right arrow keys to move the flashing cursor.



```
INTRATECH, ROOM 33           Dec 07 1986
NEUT-GND  VOLTAGE SURGE      4:29:59.29PM
    7.8 Vrms maximum
    0.9 seconds above threshold
```

```
1.0 V/div vertical   2 sec/div horiz.
       NEUT-GND   VOLTAGE SURGE
INTRATECH, ROOM 33   Dec 07 1986   4:30 PM
```

Use the number keys to enter both letters and numbers; for example, to enter the letter “K”, press the 5JKL key 3 times. On the first press, a 5 will appear; on the second, a J will appear, and on the third, a K will appear.

Now move the flashing cursor to the next position by pressing the right arrow key. Press the 0 SPACE button twice to enter a space. Press the down arrow key to go on to the next question.

HELP!

You may enter up to 20 characters from the keyboard to identify the site that you are monitoring.

Use the left and right arrow keys to move the flashing cursor.

Use the number keys to enter both letters and numbers. For example, to enter the letter 'B', push the '2ABC' key three times.

(Press HELP! again for general information on the Setup Menu.)

=====================================

=====================================

The PowerScope monitor can be in one of six modes:

1) Press the SETUP MENU key to program the Setup Menu. Use the up arrow and the down arrow key to work your way through the questions on the menu. The 'HELP!' key will always give you information on a question on the menu. (You may want to press 'HELP!' when you have selected the type of power line you are going to monitor. This will give you installation instructions.)

   By pressing the SETUP MENU key, then immediately pressing the UP ARROW key, you will enter the Key Operator Menu. This menu will give you control of the detailed operation of the PowerScope.

2) Press the STATUS key to print the Status Report. This report tells you the present voltage, frequency, and noise on each of the channels. This report can be especially useful when you're trying to set the thresholds correctly. It's also useful for checking to see if you've installed the monitor correctly.

3) Press the REPORT MENU key to enter the Report menu. Use the up arrow and the down arrow to work your way through the questions on the menu. The 'HELP!' key will always give you information on a question on the menu.

4) Press the MONITOR key to start monitoring the power line. The PowerScope will print a complete copy of your setup, and show you the initial waveshapes on each channel (if you have requested them in the Report Menu). Then it will print a disturbance report every time a power disturbance occurs.

5) Press the SELF CALIBRATE key to calibrate your PowerScope. The PowerScope has the ability to completely calibrate itself. A Calibration Report will be printed automatically, showing the calibration of all of the ranges on all of the channels.

6) Press the SELF TEST key to test the PowerScope.

The Setup Menu contains questions that define the operating parameters of your PowerScope. Specifically, it asks you to name the monitoring site, state what type of power each channel will monitor, and specify thresholds for each measurement.

The questions in the Setup Menu change automatically depending on what type of power you assign each channel and if you have probes plugged into the environmental channels.

(Press HELP! again for general information on the operating sequence.)

The usual sequence for operating the PowerScope monitor is:

1) Press the SETUP MENU key and answer the questions. To go on to the next question, press the Down Arrow.

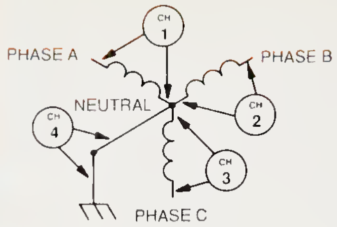
2) Connect the monitor to the power line. (See the HELP! message in the Setup Menu for the 'TYPE:' question.)

3) Press the MONITOR key to monitor the power line. Your reports will be printed automatically.

(Press HELP! again for general information on the six modes of operation.)

Three-Phase Wye

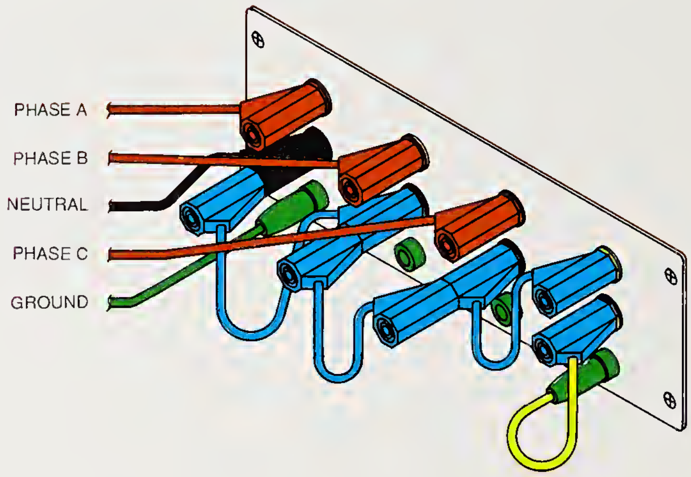
Setup Menu, continued

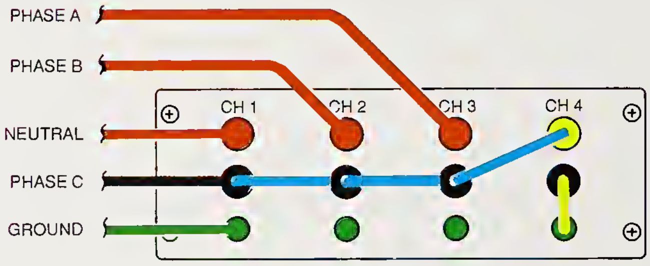


Type: 3 phase wye

Selections: Single Phase
Dual 1-phase
3 phase delta
3 phase wye
Ind. channels

Use the VALUE UP/ VALUE DOWN keys to select 3-phase wye power.

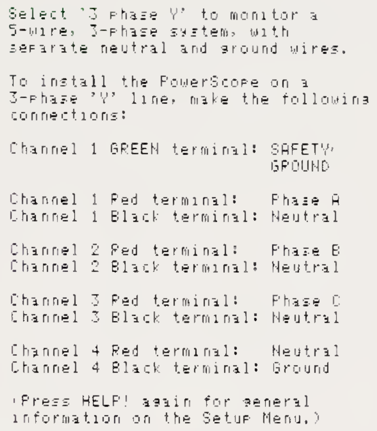




Press the HELP! key for information on connecting your PowerScope to Three-Phase Wye power, or see Part 3 of this chapter on page 178.

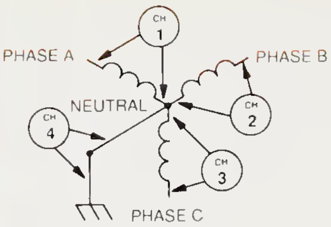
WARNING
You are working with high voltages that cause burns and lethal shocks. Connect the safety earth ground first. USE STANDARD SAFETY PRECAUTIONS.

HELP!



```
Select '3 phase Y' to monitor a
5-wire, 3-phase system, with
separate neutral and ground wires.

To install the PowerScope on a
3-phase 'Y' line, make the following
connections:

Channel 1 GREEN terminal: SAFETY/
                          GROUND

Channel 1 Red terminal:   Phase A
Channel 1 Black terminal: Neutral

Channel 2 Red terminal:   Phase B
Channel 2 Black terminal: Neutral

Channel 3 Red terminal:   Phase C
Channel 3 Black terminal: Neutral

Channel 4 Red terminal:   Neutral
Channel 4 Black terminal: Ground

(Press HELP! again for general
information on the Setup Menu.)
```

Setup Menu, continued

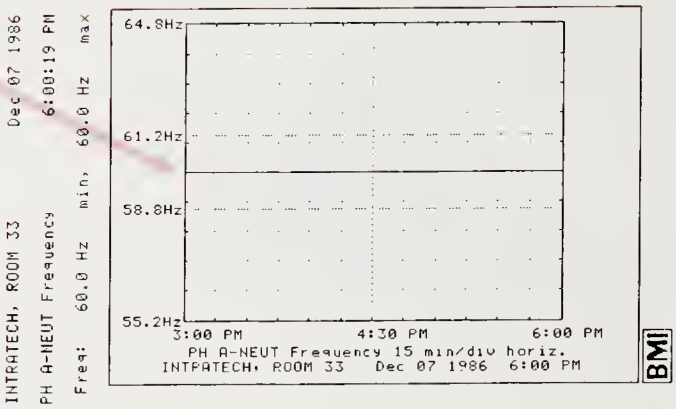


Nom. freq.: 60.0Hz

Range: 45 Hz to 400 Hz

Use the number keys to enter in the nominal frequency of the line you are monitoring.

Typical settings are 50.0 Hz, 60.0 Hz, 400.0 Hz, or 415.0 Hz.

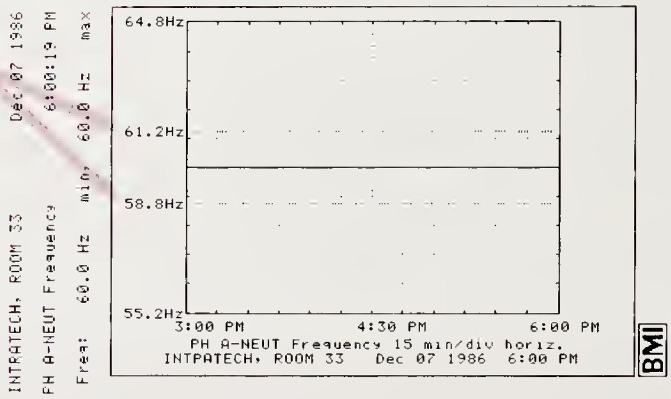


Freq. tol.: 1.2Hz

Range: 0.4Hz to 135.0Hz

Use the number keys to enter a threshold for line-frequency deviation.

The range is 1% to 30% of the nominal frequency, and is entered in Hertz. A typical value is 2% of the nominal frequency.

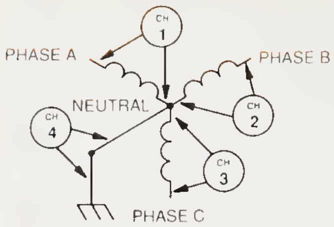


For example, if the nominal frequency setting is 50.0 Hz,
the frequency tolerance range is .5 Hz (1%) to 15 Hz (30%).
If the frequency is 60.0 Hz, the frequency tolerance range is .6 Hz to 18 Hz.
If the frequency is 400.0 Hz, the frequency tolerance range is 4.0 Hz to 120 Hz.
If the frequency is 415.0 Hz, the frequency tolerance range is 4.15 Hz to 124.5 Hz.

HELP!

```
Enter the nominal line frequency of
the line you are monitoring.  This
provides a reference to the monitor
from which it can base its measure-
ments. Typical values are 50.0 Hz,
60.0 Hz, and 400.0 Hz.  The
acceptable range is 45.0 Hz to
450.0 Hz.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

```
Enter in Hertz the amount of line
frequency deviation from nominal that
you are willing to tolerate before the
PowerScope reports a disturbance. The
range is 0.2% to 50% of your nominal
frequency setting.   A typical value
is 2% of your nominal frequency.

For example, if your nominal
frequency setting is 60 Hz., the range
is 0.1 Hz (0.2%) to 30.0 Hz (50%).
The default setting for 60 Hz is
1.2 Hz (2%).

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

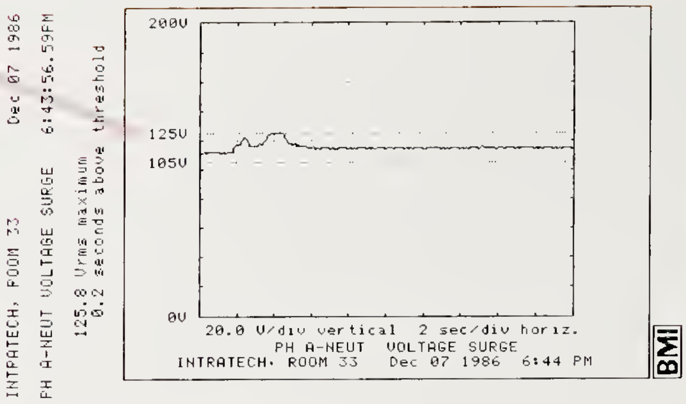


Setup Menu, continued

Surge volt: 125.0Vrms

Range: 1.0 Vrms to 600 Vrms

Use the number keys to enter the high voltage threshold for all the phases on the three-phase wye power line you are monitoring.



Phase A-to-neutral surge graph.

The usual value is about 10% above the nominal voltage. The acceptable range is 1.0 Vrms to 600.0 Vrms. The surge voltage threshold also determines the full-scale RMS voltage as follows:

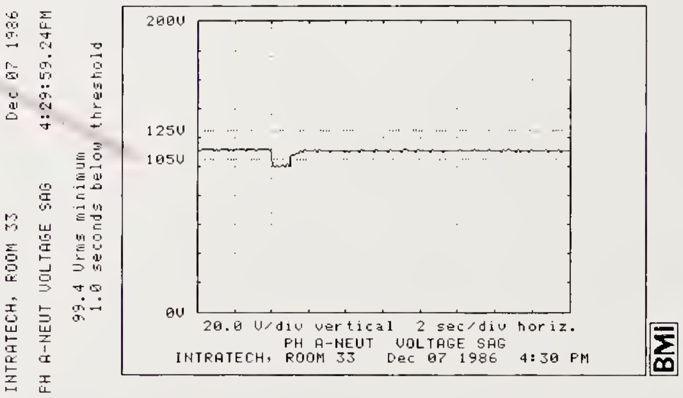
Voltage Surge Threshold Table

Surge Threshold	Full Scale
1.0 – 6.2 Vrms	10.0 Vrms
6.3 – 12.5 Vrms	20.0 Vrms
12.6 – 25.0 Vrms	40.0 Vrms
25.1 – 62.5 Vrms	100.0 Vrms
62.6 - 125.0 Vrms	200.0 Vrms
125.1 - 166.5 Vrms	250.0 Vrms
166.6 - 250.0 Vrms	400.0 Vrms
250.1 - 600.0 Vrms	800.0 Vrms

Sag volt: 105.0Vrms

Range: 0.0 Vrms to 599 Vrms

Use the number keys to enter the low-voltage threshold.



Phase A-to-neutral sag graph.

The usual value is about 15% below the nominal voltage.

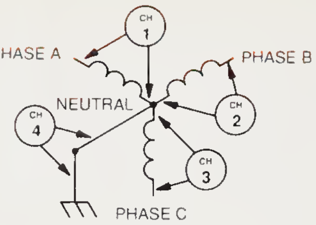
The acceptable range is 0.0 to 599.0 Vrms.

HELP!

```
Use the number keys to enter the
high voltage threshold.  The usual
value is about 10% above the nominal
voltage.  The acceptable range is
1.0 Vrms to 600.0 Vrms.

(Press HELP! again for general
information on the Setup Menu.)
```

```
Use the number keys to enter the low
voltage threshold.  The usual value is
about 15% below the nominal voltage.
The acceptable range is 0.0 Vrms to
599.9 Vrms.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued

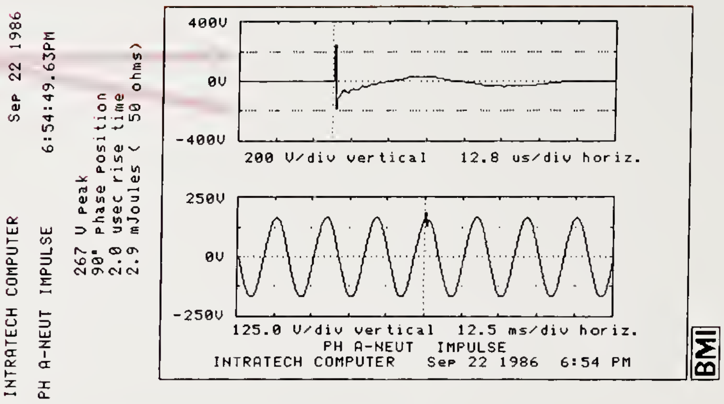


Impulse thr: 200 Vpk

Range: 20 Vpk to 6000 Vpk

Use the number keys to enter the smallest impulse you wish the PowerScope to report.

Typical thresholds are in the range of 100-250 volts. You may select any value from 20 Vpk to 6000 Vpk.



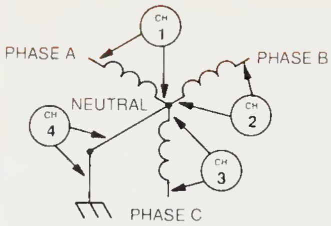
```
INTRATECH COMPUTER        Sep 22 1986
PH A-NEUT IMPULSE         6:54:49.63PM

267 V peak
90° phase position
2.0 usec rise time
2.9 mJoules ( 50 ohms)
```

Phase A-to-neutral impulse graph.

HELP!

```
Use the number keys to enter the value
of the smallest impulse you wish the
PowerScope to report. Typical
thresholds are in the range of
100-250 volts.  You may select any
value from 20 to 6000 volts.

(Press HELP! again for more infor-
mation on answering this question.)
```

```
If you choose AUTO impulse ranging in
the Key Operator Menu, the PowerScope
will choose a full scale impulse range
according to the following table:

          Impulse              Impulse
         threshold            full scale
   --------------------       ----------
     20 Vpk -   50 Vpk         100 Vpk
     51 Vpk -  100 Vpk         200 Vpk
    101 Vpk -  200 Vpk         400 Vpk
    201 Vpk -  400 Vpk         800 Vpk
    401 Vpk -  800 Vpk        1600 Vpk
    801 Vpk - 1600 Vpk        3200 Vpk
   1601 Vpk - 6000 Vpk        6400 Vpk

However, if you choose MANUAL impulse
ranging in the Key Operator Menu, you
will be asked to select a full scale
range yourself.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```



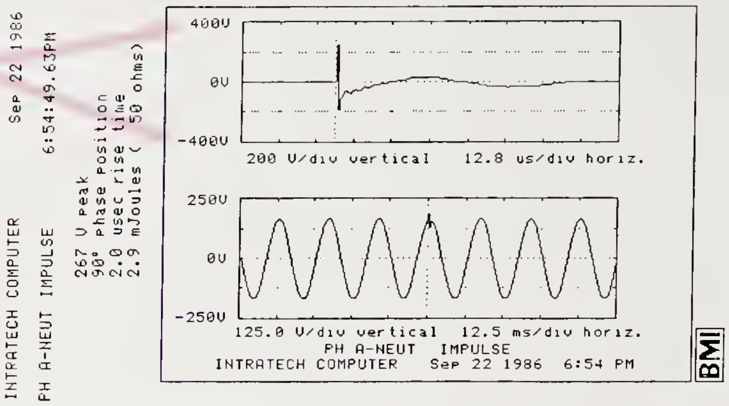
Setup Menu, continued

NOTE: The next question will only appear if you have Impulse Ranging in the Key Operator Menu set to MANUAL.

Imp. range: 400 Vpk

Possible selections: See the following table.

Use the VALUE UP/ VALUE DOWN keys to select the full-scale impulse range.



Phase A-to-neutral impulse graph.

Manual Impulse Ranging Table

Impulse Threshold	Available Full-Scale Ranges
20-24 Vpk	+/- 100 or 200 volts full-scale
24-49 Vpk	+/- 100, 200 or 400 volts full-scale
50 Vpk	+/- 100, 200, 400 or 800 volts full-scale
51-99 Vpk	+/- 200, 400 or 800 volts full-scale
100 Vpk	+/- 200, 400, 800 or 1600 volts full-scale
101-199 Vpk	+/- 400, 800 or 1600 volts full-scale
200 Vpk	+/- 400, 800, 1600 or 3200 volts full-scale
201-399 Vpk	+/- 800, 1600 or 3200 volts full-scale
400 Vpk	+/- 800, 1600, 3200 or 6400 volts full-scale
401-800 Vpk	+/- 1600, 3200 or 6400 volts full-scale

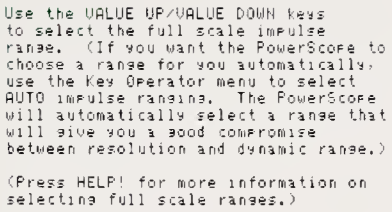
The selections depend on the impulse threshold, e.g. for a 20-24 Vpk threshold, there are 2 full-scale ranges available, 100 or 200 volts full scale.

If you selected AUTO Impulse Ranging in the Key Operator Menu (or plan to), the full-scale impulse range will be selected for you as follows:

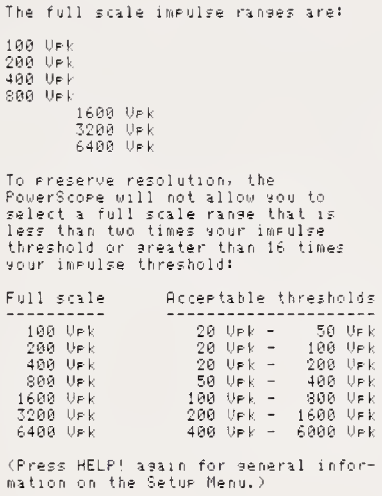
Automic Impulse Ranging Table

If Impulse Threshold selected in previous question is between...	The Impulse Range will set automatically to...
20 - 50 volts	+/- 100 volts
51 - 100 volts	+/- 200 volts
101 - 200 volts	+/- 400 volts
201 - 400 volts	+/- 800 volts
401 - 800 volts	+/- 1600 volts
801 - 1600 volts	+/- 3200 volts
1601- 6000 volts	+/- 6400 volts

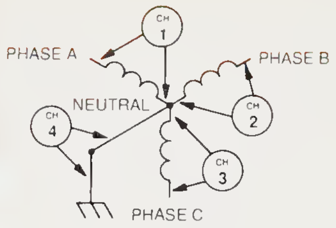
HELP!



```
Use the VALUE UP/VALUE DOWN keys
to select the full scale impulse
range.  (If you want the PowerScope to
choose a range for you automatically,
use the Key Operator menu to select
AUTO impulse ranging.  The PowerScope
will automatically select a range that
will give you a good compromise
between resolution and dynamic range.)

(Press HELP! for more information on
selecting full scale ranges.)
```



```
The full scale impulse ranges are:

100 Vpk
200 Vpk
400 Vpk
800 Vpk
       1600 Vpk
       3200 Vpk
       6400 Vpk

To preserve resolution, the
PowerScope will not allow you to
select a full scale range that is
less than two times your impulse
threshold or greater than 16 times
your impulse threshold:

Full scale      Acceptable thresholds
----------      ---------------------
  100 Vpk          20 Vpk -    50 Vpk
  200 Vpk          20 Vpk -   100 Vpk
  400 Vpk          20 Vpk -   200 Vpk
  800 Vpk          50 Vpk -   400 Vpk
 1600 Vpk         100 Vpk -   800 Vpk
 3200 Vpk         200 Vpk -  1600 Vpk
 6400 Vpk         400 Vpk -  6000 Vpk

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

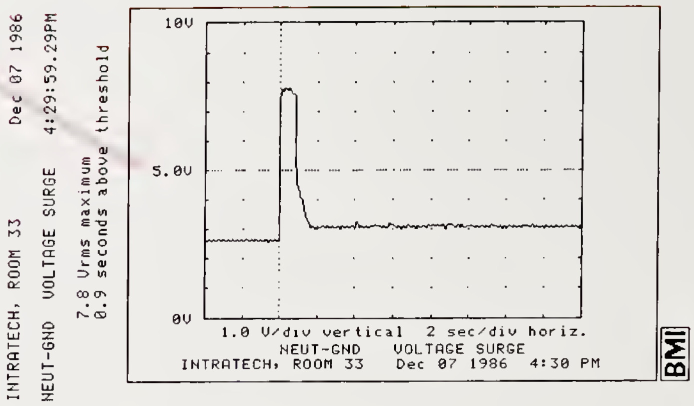


Neut-Gnd: 5.0Vrms

Range: 0.1 Vrms to 99.9 Vrms

Use the number keys to enter the surge voltage threshold for neutral-to-ground.

You may select any value from 0.1 Vrms to 99.9 Vrms. (Typical thresholds range between 1.0 and 10.0 Vrms.)



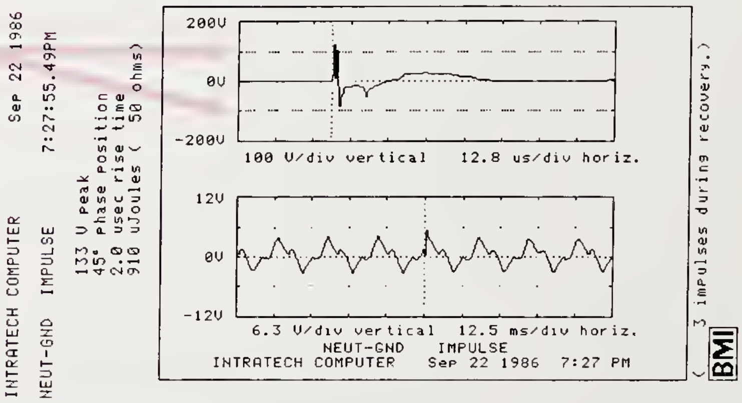
Neutral-to-ground surge graph.

N-G Imp thr: 100Vpk

Range: 0.1 Vrms to 99.9 Vrms

Use the number keys to enter the smallest neutral-to-ground impulse you want the PowerScope to graph.

Typical thresholds range between 50-250 volts. You may select any value from 20 volts to 6000 volts.

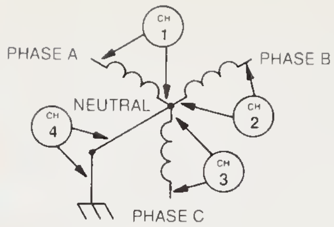


Neutral-to-ground impulse graph.

HELP!

```
Use the number keys to enter the
acceptable ac voltage difference
between the neutral and ground lines
being monitored by the PowerScope.
Typical thresholds are in the range
of 1.0-10.0 Vrms.  You may select any
value from 0.1 Vrms to 99.9 Vrms.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

```
Use the number keys to enter the
value of the smallest neutral-ground
impulse you wish the PowerScope to
report. Typical thresholds are in the
range of 50-250 volts.  You may
select any value from 20 to 6000
volts.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```



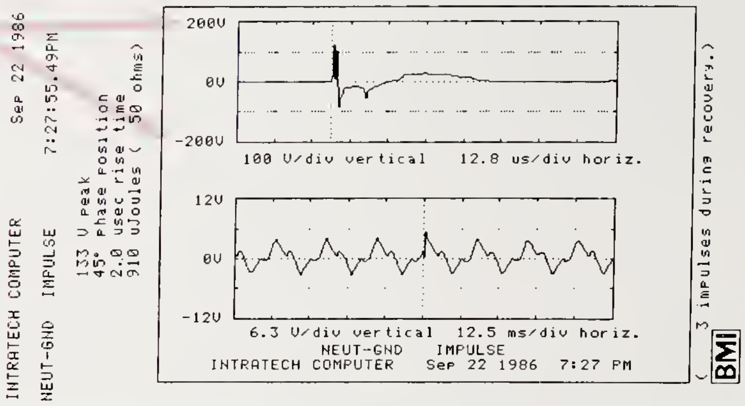
Setup Menu, continued

NOTE: You'll only get the next question if you have Impulse Ranging in the Key Operator Menu set to MANUAL.

N-G imp. range: 200 Vpk

Possible selections: See the following table.

Use the VALUE UP/ VALUE DOWN keys to select the full-scale impulse range for neutral-to-ground.


INTRATECH COMPUTER Sep 22 1986
NEUT-GND IMPULSE 7:27:55.49PM
133 V peak
45° phase position
2.0 usec rise time
910 uJoules (50 ohms)
(3 impulses during recovery.)

Neutral-to-ground impulse graph.

The selections depend on the impulse threshold, e.g. for a 20-24 Vpk threshold, there are 2 full-scale ranges available, 100 or 200 volts full-scale.

Manual Impulse Ranging Table

Impulse Threshold	Available Full-Scale Ranges
20-24 Vpk	+/-100 or 200 volts full-scale
24-49 Vpk	+/-100, 200 or 400 volts full-scale
50 Vpk	+/-100, 200, 400 or 800 volts full-scale
51-99 Vpk	+/-200, 400 or 800 volts full-scale
100 Vpk	+/-200, 400, 800 or 1600 volts full-scale
101-199 Vpk	+/-400, 800 or 1600 volts full-scale
200 Vpk	+/-400, 800, 1600 or 3200 volts full-scale
201-399 Vpk	+/-800, 1600 or 3200 volts full-scale
400 Vpk	+/-800, 1600, 3200 or 6400 volts full-scale
401-800 Vpk	+/-1600, 3200 or 6400 volts full-scale

If you selected AUTO Impulse Ranging in the Key Operator Menu (or plan to), the full-scale impulse range will be selected for you as follows:

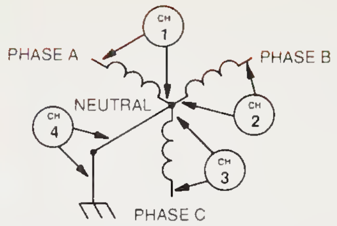
Automatic Impulse Ranging Table

The Impulse Range will set automatically to...	If Impulse Threshold selected in previous question is between...
+/- 100 volts	20 - 50 volts
+/- 200 volts	51 - 100 volts
+/- 400 volts	101 - 200 volts
+/- 800 volts	201 - 400 volts
+/- 1600 volts	401 - 800 volts
+/- 3200 volts	801 - 1600 volts
+/- 6400 volts	1601- 6000 volts

HELP!

```
Use the VALUE UP/VALUE DOWN keys
to select the full scale impulse
range.  (If you want the PowerScope to
choose a range for you automatically,
use the Key Operator menu to select
AUTO impulse ranging.  The PowerScope
will automatically select a range that
will give you a good compromise
between resolution and dynamic range.)

(Press HELP! for more information on
selecting full scale ranges.)
```

```
The full scale impulse ranges are:

100 Vpk
200 Vpk
400 Vpk
800 Vpk
        1600 Vpk
        3200 Vpk
        6400 Vpk

To preserve resolution, the
PowerScope will not allow you to
select a full scale range that is
less than two times your impulse
threshold or greater than 16 times
your impulse threshold:

Full scale      Acceptable thresholds
----------      ---------------------
  100 Vpk          20 Vpk -    50 Vpk
  200 Vpk          20 Vpk -   100 Vpk
  400 Vpk          20 Vpk -   200 Vpk
  800 Vpk          50 Vpk -   400 Vpk
 1600 Vpk         100 Vpk -   800 Vpk
 3200 Vpk         200 Vpk -  1600 Vpk
 6400 Vpk         400 Vpk -  6000 Vpk

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

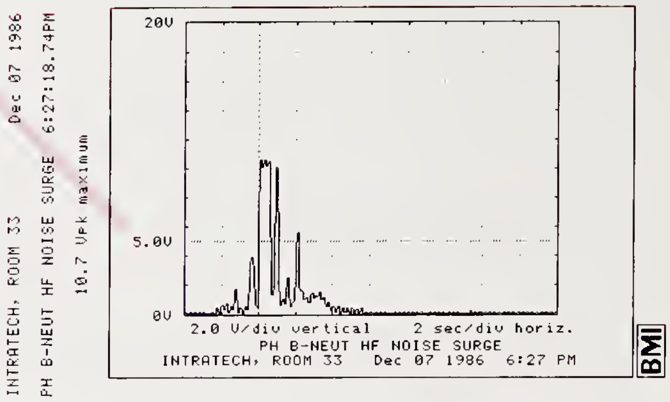


Hi. freq. noise: 5.0V

Range: 1.0 V to 19.9 V

Use the number keys to enter the high-frequency noise disturbance threshold (measured in peak-to-peak volts).

This threshold applies to all the phases of three-phase wye.



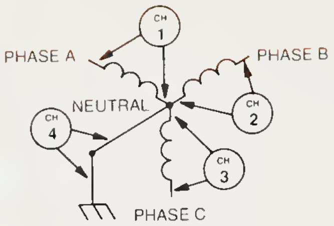
Phase B-to-neutral high-frequency noise disturbance graph.

A typical threshold is 5.0 Vpk. The acceptable range is 1.0 Vpk to 19.9 Vpk.

NOTE: If you are using probes for environmental monitoring there will be additional questions. See page 258 for an explanation of environmental thresholds.

HELP!

```
Use the number keys to enter the
high frequency noise disturbance
threshold (measured in peak-to-peak
volts).  A typical threshold is
5.0 Vpk.  The acceptable range is
1.0 Vpk to 19.9 Vpk.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```



The Report Menu lets you choose the graphs and summary reports your PowerScope prints. For a complete discussion of graphs and summary reports, see Appendix E.

Quick Guide

1. **Press the REPORT MENU key.**

2. **Use the VALUE UP/VALUE DOWN keys to answer the questions in the menu.**

3. **Press the down arrow to go to the next question.**

4. **Press the HELP! key if you want further explanation about the questions.**

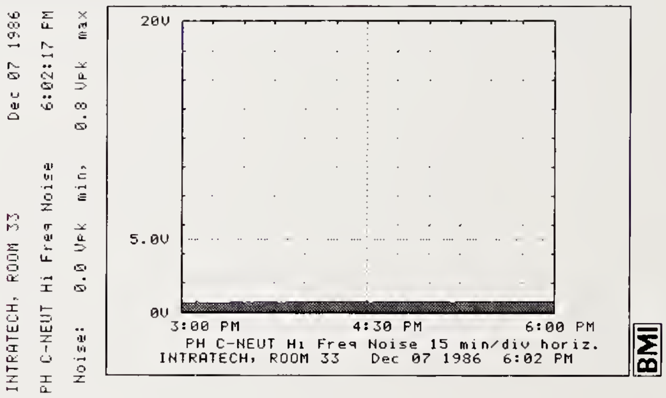
Press the REPORT MENU key now.

If you get the following message in the display, it's because the PowerScope has strip charts from the previous monitoring period.

Summary rpts: Print

Possible selections: Print
Clear

Use the VALUE UP/ VALUE DOWN keys to choose whether you want the pending strip charts.



This is a summary strip chart.

If you want them printed then erased, position PRINT in the display, then press the down arrow. If you want them erased immediately, position CLEAR in the display, then press the down arrow.

Then, press the REPORT MENU key again and proceed.

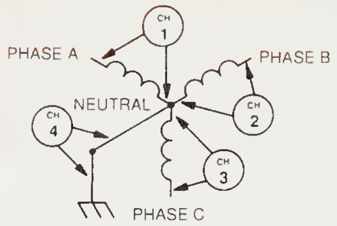
HELP!

Use the VALUE UP/VALUE DOWN keys to select PRINT or CLEAR and then use the DOWN ARROW key to enter the menu you have selected.

If you select PRINT, the summary data and strip charts that have been gathered so far by the PowerScope will be printed and then reset. If you select CLEAR, all of the summary data and strip charts will be reset without printing.

If you don't want to lose any summary data, you may return to the Monitor mode by pressing the MONITOR key.

Report Menu, continued

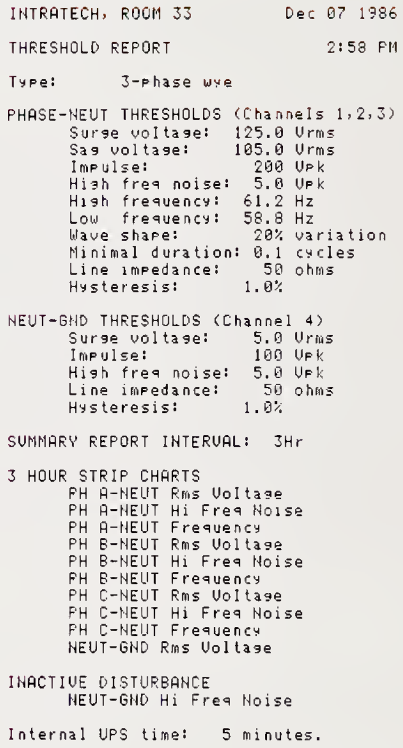


Threshold report: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN key to turn the Threshold report on or off.

Your PowerScope prints the Threshold Report after you press the MONITOR key. The Threshold Report shows all the current settings. Generally, you should leave this report on.



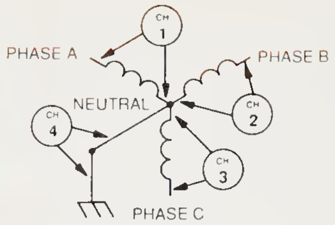
```
INTRATECH, ROOM 33          Dec 07 1986

THRESHOLD REPORT                2:58 PM

Type:      3-phase wye

PHASE-NEUT THRESHOLDS (Channels 1,2,3)
      Surge voltage:  125.0 Vrms
      Sag voltage:    105.0 Vrms
      Impulse:          200 Vpk
      High freq noise:  5.0 Vpk
      High frequency:  61.2 Hz
      Low  frequency:  58.8 Hz
      Wave shape:       20% variation
      Minimal duration: 0.1 cycles
      Line impedance:    50 ohms
      Hysteresis:      1.0%

NEUT-GND THRESHOLDS (Channel 4)
      Surge voltage:    5.0 Vrms
      Impulse:          100 Vpk
      High freq noise:  5.0 Vpk
      Line impedance:    50 ohms
      Hysteresis:      1.0%

SUMMARY REPORT INTERVAL:  3Hr

3 HOUR STRIP CHARTS
      PH A-NEUT Rms Voltage
      PH A-NEUT Hi Freq Noise
      PH A-NEUT Frequency
      PH B-NEUT Rms Voltage
      PH B-NEUT Hi Freq Noise
      PH B-NEUT Frequency
      PH C-NEUT Rms Voltage
      PH C-NEUT Hi Freq Noise
      PH C-NEUT Frequency
      NEUT-GND Rms Voltage

INACTIVE DISTURBANCE
      NEUT-GND Hi Freq Noise

Internal UPS time:   5 minutes.
```

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
turn the Threshold Report on or off.
This report should normally be left
on.

(Press HELP! again for more infor-
mation on Threshold Reports).

======================================

======================================

The usual sequence for operating
the PowerScope monitor is:

  1) Press the SETUP MENU key and
     answer the questions.
     To go on to the next question,
     press the Down Arrow.

  2) Connect the monitor to the
     power line. (See the HELP!
     message in the Setup Menu
     for the 'TYPE:' question.)

  3) Press the MONITOR key to monitor
     the power line.  Your reports
     will be printed automatically.

(Press HELP! again for general infor-
mation on the six modes of operation.)
```

```
The Threshold Report is the list of
thresholds and settings your
PowerScope can print automatically
before it begins monitoring.

(If you turn the Threshold Report
on now, you can still omit it when
you begin monitoring by pressing
the MONITOR key followed immediately
by the UP ARROW key.)

(Press HELP! again for general infor-
mation on the Report Menu).

======================================

======================================

The PowerScope monitor can be in one
of six modes:

    1) Press the SETUP MENU key to
       program the Setup Menu.
       Use the up arrow and the down
       arrow key to work your way
       through the questions on the
       menu. The 'HELP!' key will
       always give you information
       on a question on the menu.
       (You may want to press 'HELP!'
       when you have selected the type
       of power line you are going to
       monitor. This will give you
       installation instructions.)

       By pressing the SETUP MENU key,
       then immediately pressing the
       UP ARROW key, you will enter
       the Key Operator Menu.  This
       menu will give you control of
       the detailed operation of the
       PowerScope.

    2) Press the STATUS key to print
       the Status Report.  This
       report tells you the present
       voltage, frequency, and noise
       on each of the channels.  This
       report can be especially
       useful when you're trying to
       set the thresholds correctly.
       It's also useful for checking
       to see if you've installed the
       monitor correctly.

    3) Press the REPORT MENU key to
       enter the Report menu.  Use
       the up arrow and the down
       arrow to work your way through
       the questions on the menu.
       The 'HELP!' key will always
       give you information on a
       question on the menu.

    4) Press the MONITOR key to start
       monitoring the power line.
       The PowerScope will print a
       complete copy of your setup,
       and show you the initial wave-
       shapes on each channel (if you
       have requested them in the
       Report Menu).  Then it will
       print a disturbance report
       every time a power disturbance
       occurs.

    5) Press the SELF CALIBRATE key
       to calibrate your PowerScope.
       The PowerScope has the ability
       to completely calibrate itself.
       A Calibration Report will be
       printed automatically, showing
       the calibration of all of the
       ranges on all of the channels.

    6) Press the SELF TEST key to test
       the PowerScope.

 There is no more HELP!)
```

```
The Report Menu contains questions
that define the type of summary strip
charts you would like, and over what
time duration you would like them.

The questions in the Report Menu
vary depending on the type of power
each channel is monitoring, and if
you have probes plugged into the
environmental channels.

(Press HELP! again for general
information on the operating
sequence.
```

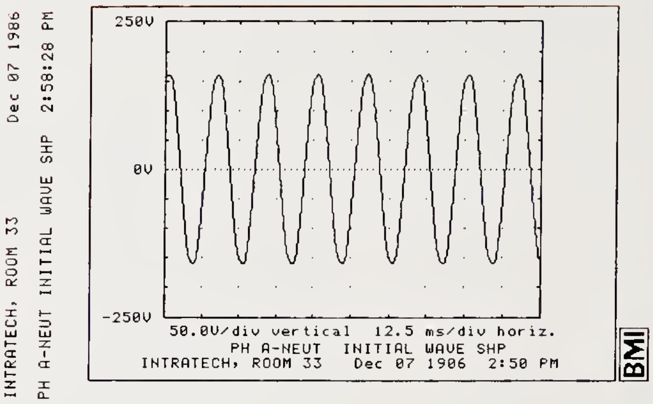


Report Menu, continued

Initial waves: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn the initial waveshape graphs on or off.

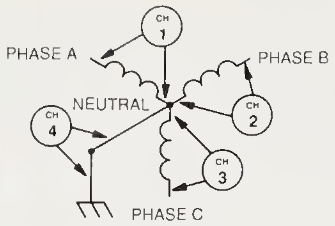


Your PowerScope prints initial waveshape graphs after the Threshold Report. These graphs show the initial condition of the sine-waves. Generally you should leave these graphs turned on.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
turn the Initial Waveshape Report on
or off. This report should normally
be left on.

(Press HELP! again for more infor-
mation on the Initial Waveshape
Report).
```

```
The Initial Waveshape Report shows the
condition of the sine waves at the
beginning of the monitoring session.
Initial waveshapes may give you
additional information on the
condition of the power lines.

(Press HELP! again for general infor-
mation on the Report Menu).
```

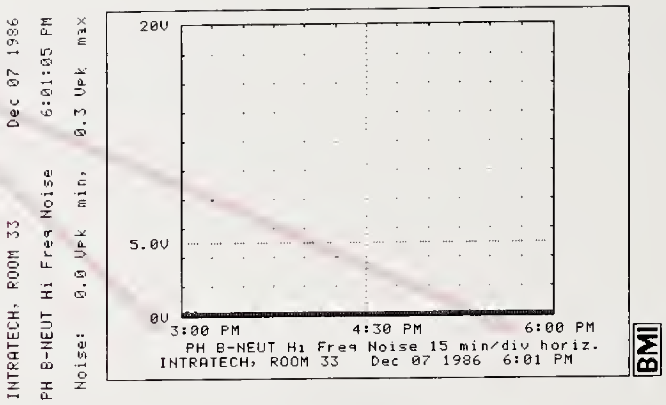


Report Menu, continued

Strip charts: 3 Hr

Selections:
- 24 Hr
- 12 Hr
- 6 Hr
- 3 Hr
- 1 Hr
- Off

Use the VALUE UP/ VALUE DOWN keys to select the strip chart interval.



```
INTRATECH, ROOM 33          Dec 07 1986
PH B-NEUT Hi Freq Noise     6:01:05 PM
Noise:   0.0 Vpk  min,   0.3 Vpk  max
```

Phase A-to-neutral 3-hr strip chart.

```
INTRATECH, ROOM 33          Dec 07 1986

STRIP CHART REPORT              6:00 PM
 From  3:00 PM  To  6:00 PM

PH A-NEUT  (Channel 1)
 Rms:     91.2 Vrms min, 115.4 Vrms max
 Noise:    0.2 Vpk  min,   1.1 Vpk  max
 Freq:    60.0 Hz   min,  60.0 Hz   max
 Imp:        1 counted,   222  Vpk  max

PH B-NEUT  (Channel 2)
 Rms:     91.2 Vrms min, 115.7 Vrms max
 Noise:    0.0 Vpk  min,   0.3 Vpk  max
 Freq:    60.0 Hz   min,  60.0 Hz   max
 Imp:        0 counted

PH C-NEUT  (Channel 3)
 Rms:     91.0 Vrms min, 115.5 Vrms max
 Noise:    0.0 Vpk  min,   0.8 Vpk  max
 Freq:    60.0 Hz   min,  60.0 Hz   max
 Imp:        1 counted,   337  Vpk  max

NEUT-GND  (Channel 4)
 Rms:      1.4 Vrms min,> 10.0 Vrms max
 Noise:    0.0 Vpk  min,   0.5 Vpk  max
 Imp:        3 counted, > 200  Vpk  max
```

Strip chart summary.

If you choose:

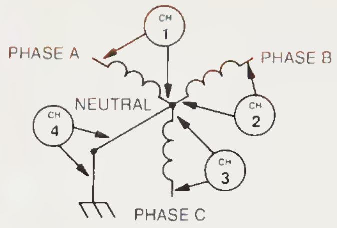
24 hr–strip charts will be printed every 24 hours at midnight.
12 hr–strip charts will be printed every 12 hours beginning at 12:00.
6 hr–strip charts will be printed every 6 hours beginning at 6:00.
3 hr–strip charts will be printed every 3 hours beginning at 3:00.
1 hr–strip charts will be printed every hour on the hour.
Off–no long-term summary information will be printed.

NOTE: Whatever strip chart interval you choose here will appear in the forthcoming questions.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the time interval between
printing strip charts and summary
reports.

Possible selections are: 24 hours,
12 hours, 6 hours, 3 hours, 1 hour,
or OFF.  The interval that you choose
impacts the choices offered you in the
next series of questions.

(Press HELP! for more information on
selecting strip chart summary
reports).
```

```
If you choose, for example, 12-hour
strip chart summaries, your choices
in the next questions regarding
individual strip chart summary reports
will include 12-hour strip charts.
(If you choose 3-hour strip charts
here, your choices in the next
questions will include 3-hour strip
charts, and so on.)

(Press HELP! for general information
on the Setup Menu.)
```

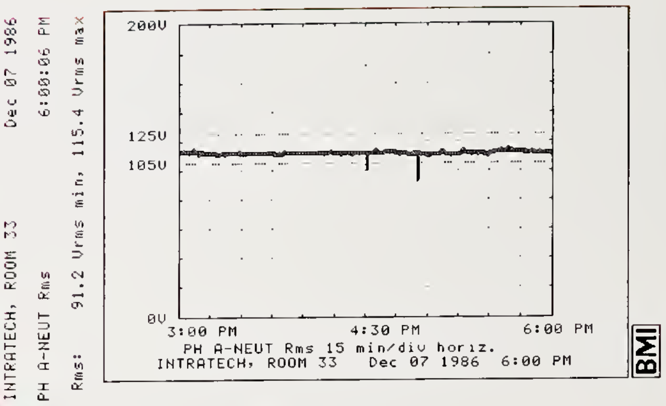


Report Menu, continued

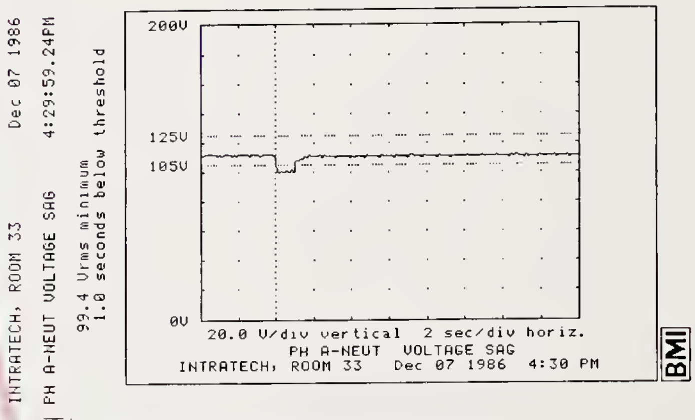
PH A-NEUT Rms: Both

Selections: Both
3 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the Rms signal on the phase A-to-neutral line.



3-Hr strip chart: phase A-to-neutral Rms.



Graph: phase A-to-neutral Rms disturbance.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

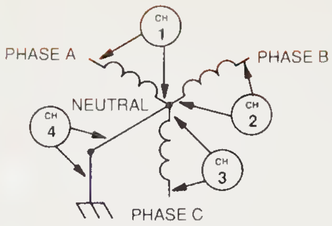
3-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

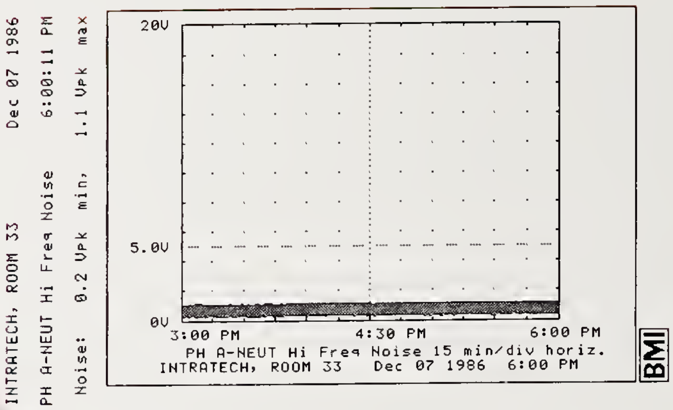
```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a disturbance graph of this
signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance graphs.

If you choose GRAPH, your PowerScope
will graph all disturbances for this
signal but will not print a strip
chart for this signal.

If you choose OFF, your PowerScope
will print neither disturbance graphs
nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu, you
will not have the choice of a strip
chart summary in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```



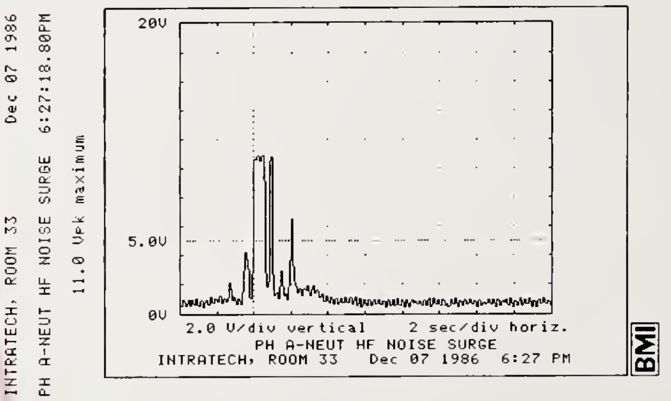
PH A-NEUT HFN: Both

Selections: Both
3 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the high-frequency noise disturbances on the A-to-neutral line.



3-Hr strip chart: phase a-to-neutral high-frequency noise.



Graph: phase A-to-neutral high-frequency noise disturbance.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

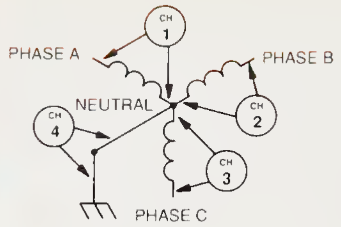
3-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

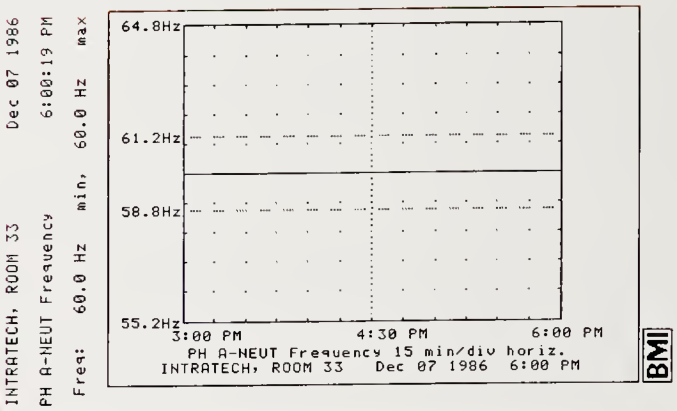
```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a disturbance graph of this
signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance graphs.

If you choose GRAPH, your PowerScope
will graph all disturbances for this
signal but will not print a strip
chart for this signal.

If you choose OFF, your PowerScope
will print neither disturbance graphs
nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu, you
will not have the choice of a strip
chart summary in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```



PH A-NEUT Freq: Both

Selections: Both
3 Hr
Text
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for phase A-to-neutral frequency signal.



3-Hr strip chart: phase A-to-neutral frequency.

```
INTRATECH, ROOM 33          Dec 07 1986
PH A-NEUT LOW FREQ.      6:44:14.08PM
     Frequency below:        58.8 Hz

--------------------------------------
INTRATECH, ROOM 33          Dec 07 1986
PH A-NEUT LOW FREQ END   6:44:18.21PM
     Minimum frequency:      57.9Hz
```

Text report: phase A-to-neutral frequency.

If you choose:

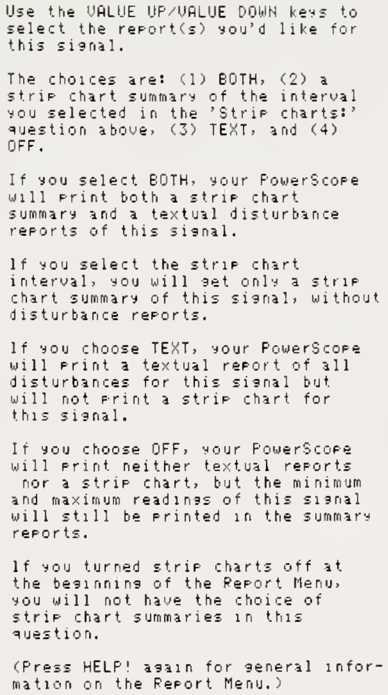
Both - your PowerScope will print both strip charts and text reports.

3-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance text reports.

Text - your PowerScope will print disturbance text reports of this signal, but won't print strip charts.

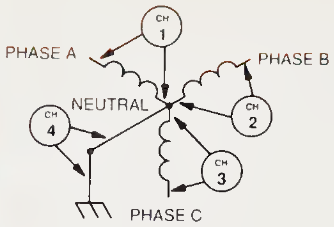
Off - no disturbance text reports or strip charts will be printed for this signal, however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!



```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above, (3) TEXT, and (4)
OFF.

If you select BOTH, your PowerScope
will print both a strip chart
summary and a textual disturbance
reports of this signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance reports.

If you choose TEXT, your PowerScope
will print a textual report of all
disturbances for this signal but
will not print a strip chart for
this signal.

If you choose OFF, your PowerScope
will print neither textual reports
 nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu,
you will not have the choice of
strip chart summaries in this
question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

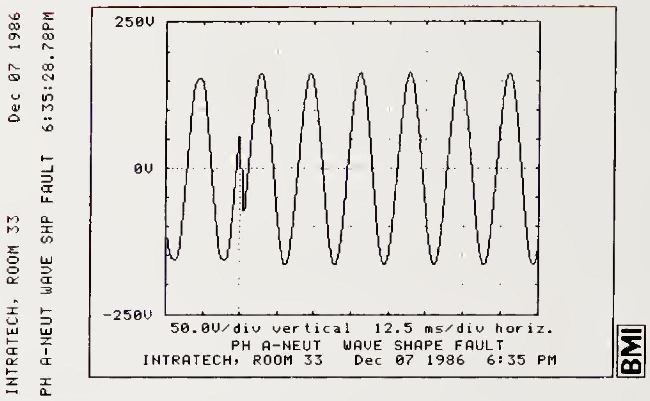
Report Menu, continued



PH A-NEUT Wave: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn phase A-to-neutral waveshape fault graphs on or off.

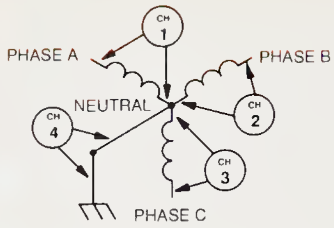


Phase A-to-neutral waveshape fault graph.

HELP!

Use the VALUE UP/VALUE DOWN keys to turn on or off the Waveshape fault disturbance reporting for this signal.

(Press HELP! again for general information on the Report Menu.)

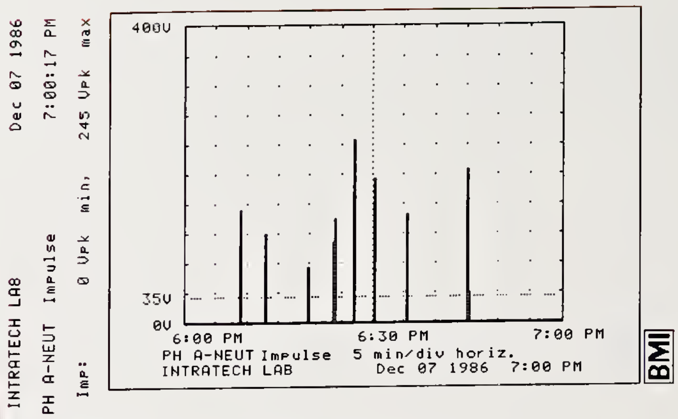


Report Menu, continued

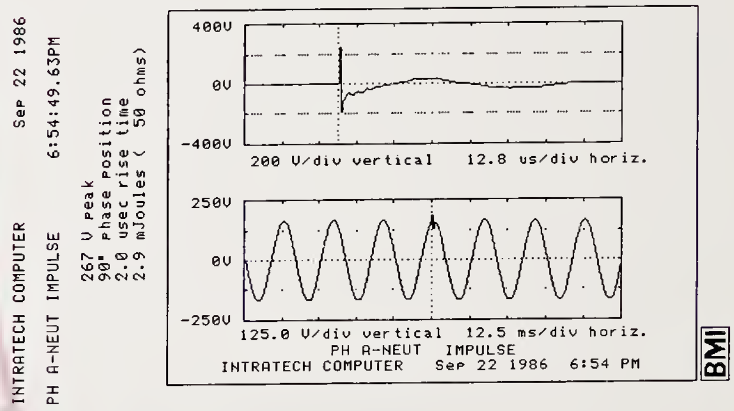
PH A-NEUT Imp: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for phase A-to-neutral impulses.



1-Hr strip chart: phase A-to-neutral impulse.



Graph: phase A-to-neutral impulse.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the maximum reading of this signal will be reported textually in the summary reports.

phase B-to-neutral phase C-to-neutral

The sections of the Report Menu that explain reporting for phase B-to-neutral and phase C-to-neutral are exactly the same as the section for phase A-to-neutral. Refer to pages 162 to 170 for an explanation of these menu items. See pages 172 to 176 for an explanation of Report Menu items for neutral-to-ground.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

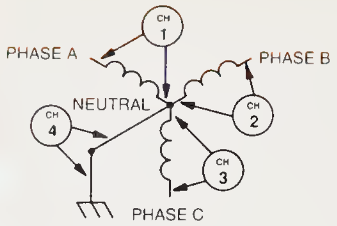
If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

(Press HELP! again for general information on the Report Menu.)

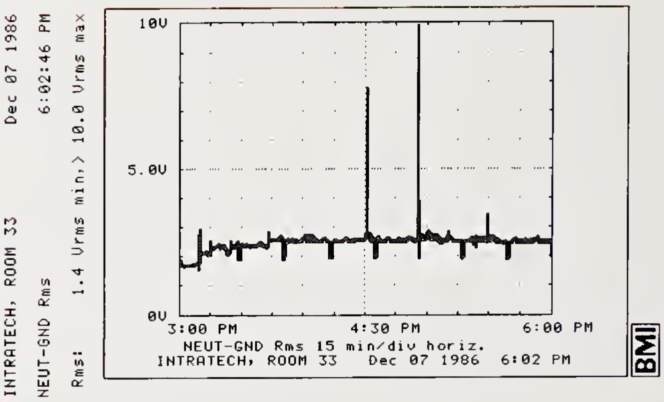


Report Menu, continued

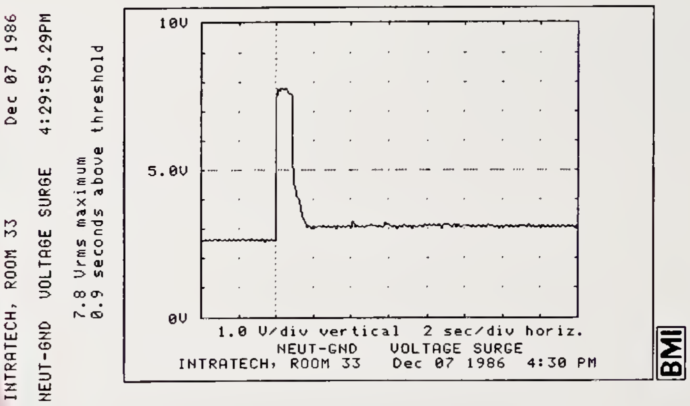
NEUT-GND Rms: Both

Selections: Both
3 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the neutral-to-ground Rms signal.



3-Hr strip chart: neutral-to-ground Rms.



Graph: neutral-to-ground Rms disturbance.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

3-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

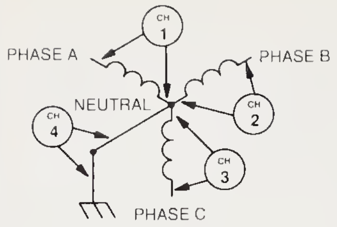
If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

(Press HELP! again for general information on the Report Menu.)

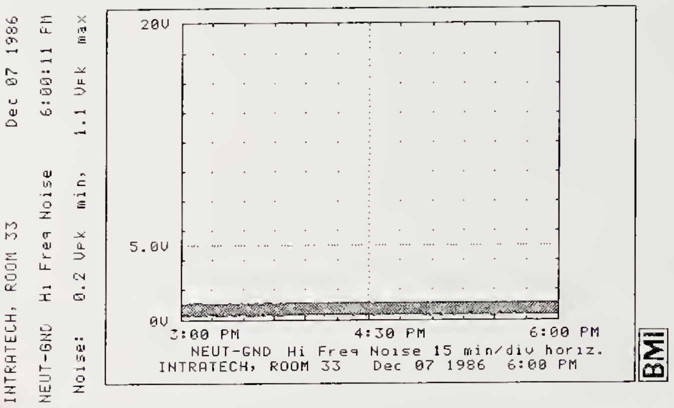


Report Menu, continued

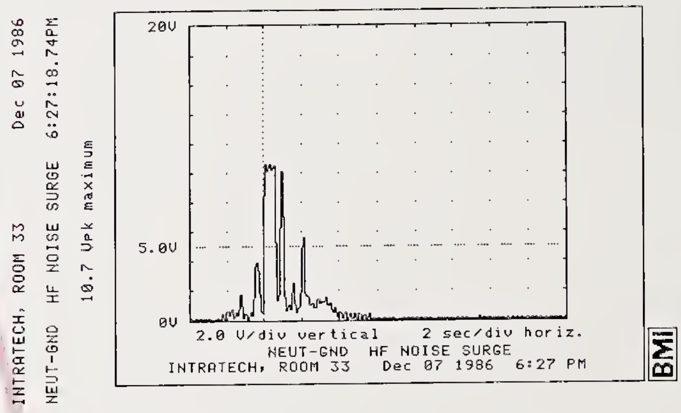
NEUT-GND HFN: Both

Selections: Both
3 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting like for the high-frequency noise signal on neutral-to-ground.



3-Hr strip chart: neutral-to-ground high-frequency noise.



Graph: neutral-to-ground high-frequency noise.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

3-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

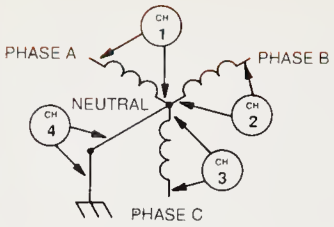
If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

(Press HELP! again for general information on the Report Menu.)

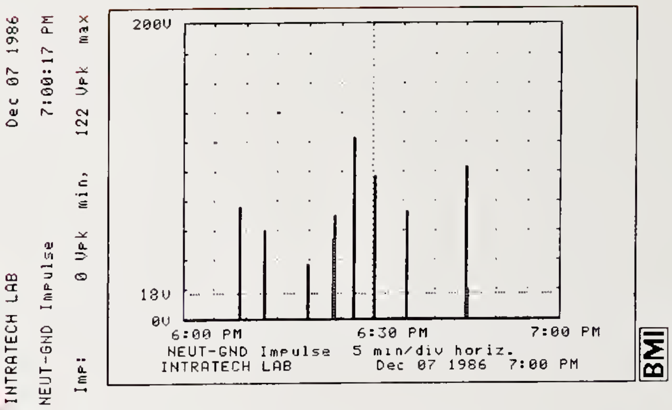


Report Menu, continued

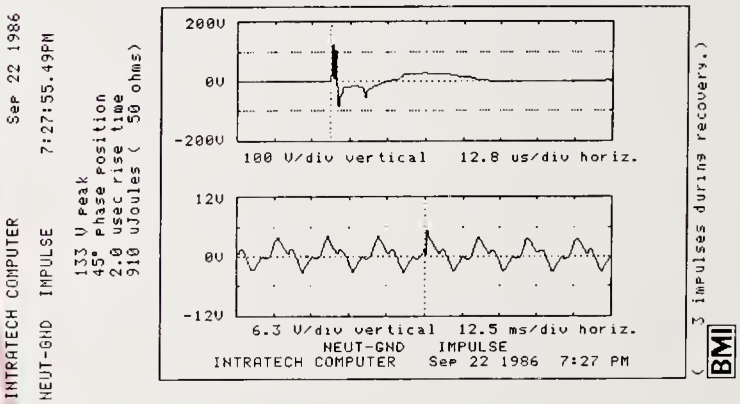
NEUT-GND Imp: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for neutral-to-ground impulse graphs.



1-Hr strip chart: neutral-to-ground impulse.



Graph: neutral-to-ground impulse.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

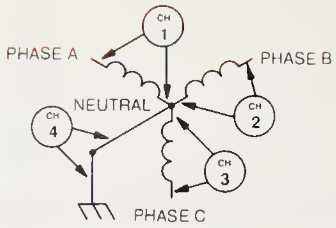
Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the maximum reading of this signal will be reported textually in the summary reports.

If you are using probes, there will be more questions. See Chapter 6 for an explanation of Report Menu questions for probes.

HELP!

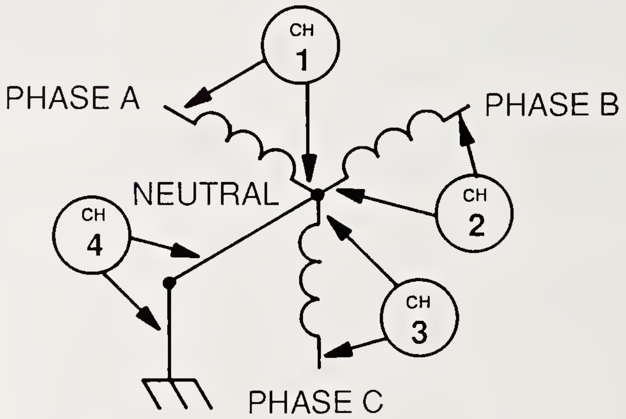
```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a disturbance graph of this
signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance graphs.

If you choose GRAPH, your PowerScope
will graph all disturbances for this
signal but will not print a strip
chart for this signal.

If you choose OFF, your PowerScope
will print neither disturbance graphs
nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu, you
will not have the choice of a strip
chart summary in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```



Part 3: Connecting to Three-Phase Wye

WARNING
You are working with high voltages that cause burns and lethal shocks. Connect the safety earth ground first. USE STANDARD SAFETY PRECAUTIONS.

Part 3 discusses how to connect your PowerScope to monitor three-phase wye power.



You need four channels to monitor three-phase wye power.

1. Using a green ground cable, connect the ground line to Channel 1 green (ground).

2. Using a red cable connect phase A to Channel 1 red (positive).

3. Using a black cable, connect neutral to a blue jumper, then to Channel 1 black (negative).

4. Connect the other end of the jumper cable to Channel 2 black (negative).

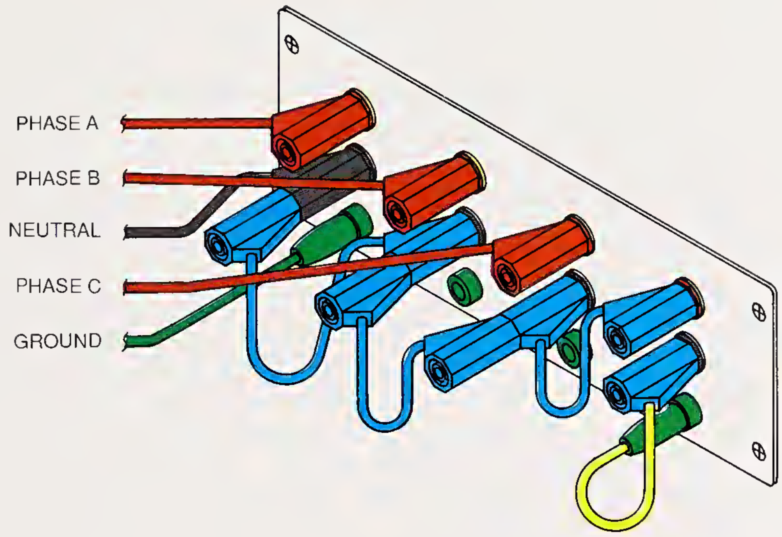
5. Using a red cable, connect phase B to Channel 2 red (positive).

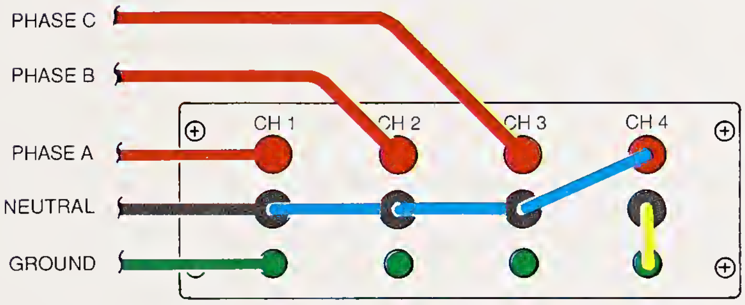
6. Using a red cable connect phase C to Channel 3 red (positive).

7. Connect a blue jumper cable from Channel 3 black (negative) to Channel 4 red (positive).

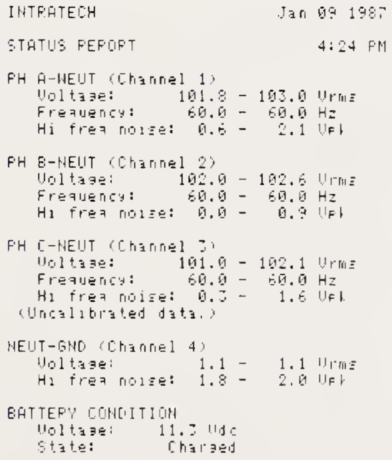
8. Connect a blue jumper cable from Channel 2 black (negative) to Channel 3 black (negative).

9. Connect a yellow ground cable from Channel 4 black (negative) to Channel 4 green (ground).





Press the STATUS key to get a printout verifying that you've connected correctly, and that your initial readings are within the thresholds you've set.



```
INTRATECH                      Jan 09 1987

STATUS REPORT                      4:24 PM

PH A-NEUT (Channel 1)
   Voltage:      101.8 - 103.0 Vrms
   Frequency:     60.0 -  60.0 Hz
   Hi freq noise:  0.6 -   2.1 Vpk

PH B-NEUT (Channel 2)
   Voltage:      102.0 - 102.6 Vrms
   Frequency:     60.0 -  60.0 Hz
   Hi freq noise:  0.0 -   0.9 Vpk

PH C-NEUT (Channel 3)
   Voltage:      101.0 - 102.1 Vrms
   Frequency:     60.0 -  60.0 Hz
   Hi freq noise:  0.3 -   1.6 Vpk
 (Uncalibrated data.)

NEUT-GND (Channel 4)
   Voltage:        1.1 -   1.1 Vrms
   Hi freq noise:  1.8 -   2.0 Vpk

BATTERY CONDITION
   Voltage:    11.3 Vdc
   State:       Charged
```

Press the MONITOR key to begin monitoring.

This chapter describes how to set-up the PowerScope to monitor DC or with customized setups.

Quick Guide

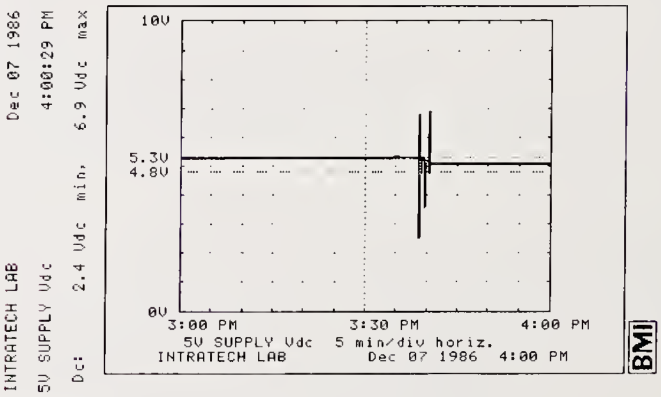
1. **Press the SETUP MENU key.**
2. **Use the VALUE UP/VALUE DOWN keys to answer the questions in the menu.**
3. **Press the down arrow key to go onto the next question.**
4. **Press the HELP! key if you want further explanation about the question or on what to do next.**

Press the SETUP MENU key now.

If you get the following message in the display, it's because the PowerScope has strip charts from a previous monitoring period.

Summary rpts: Print

Possible selections: Print
Clear



Summary strip chart.

Use the VALUE UP/ VALUE DOWN keys to choose whether you want the pending strip charts.

If you want them printed then erased, position PRINT in the display, then press the down arrow. If you want them erased immediately, position CLEAR in the display, then press the down arrow.

Then press SETUP MENU again and proceed.

HELP!

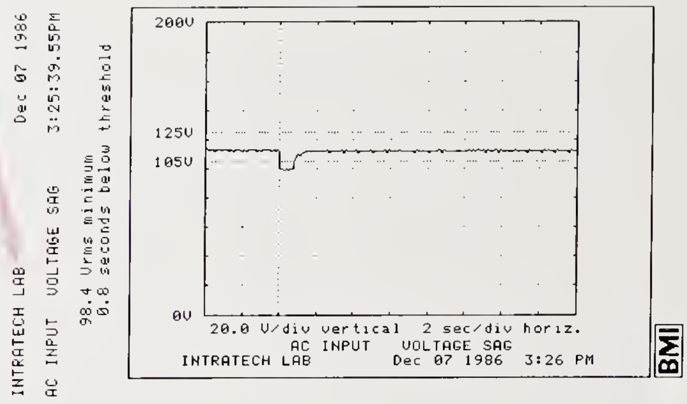
```
Use the VALUE VP/VALUE DOWN keys to
select PRINT or CLEAR and then
use the DOWN ARROW key to enter
the menu you have selected.

If you select PRINT, the summary data
and strip charts that have been
gathered so far by the PowerScope will
be printed and then reset. If you
select CLEAR, all of the summary
data and strip charts will be reset
without printing.

If you don't want to lose any summary
data, you may return to the Monitor
mode by pressing the MONITOR key.
```

Site: INTRATECH LAB

Use the number keys to enter the name of the site you are monitoring.

The name can be up to 20 characters long.

Use the left and right arrow keys to move the flashing cursor.



```
INTRATECH LAB        Dec 07 1986
AC INPUT  VOLTAGE SAG     3:25:39.55PM
 98.4 Vrms minimum
  0.8 seconds below threshold
```

Use the number keys to enter both letters and numbers; for example, to enter the letter “K”, press the 5JKL key 3 times. On the first press, a 5 will appear; on the second, a J will appear, and on the third, a K will appear.

Now move the flashing cursor to the next position by pressing the right arrow key. Press the 0 SPACE button twice to enter a space. Press the down arrow key to go on to the next question.

HELP!

```
You may enter up to 20 characters from
the keyboard to identify the site
that you are monitoring.

Use the left and right arrow keys to
move the flashing cursor.

Use the number keys to enter both
letters and numbers.  For example,
to enter the letter 'B',  push the
'2ABC' key three times.

(Press HELP! again for general
information on the Setup Menu.)
```

```
The Setup Menu contains questions that
define the operating parameters of
your PowerScope.   Specifically, it
asks you to name the monitoring site,
state what type of power each channel
will monitor, and specify thresholds
for each measurement.

The questions in the Setup Menu change
automatically depending on what type
of power you assign each channel and
if you have probes plugged into the
environmental channels.

(Press HELP! again for general infor-
mation on the operating sequence.)
```

```
The usual sequence for operating
the PowerScope monitor is:

  1) Press the SETUP MENU key and
     answer the questions.
     To go on to the next question,
     press the Down Arrow.

  2) Connect the monitor to the
     power line. (See the HELP!
     message in the Setup Menu
     for the 'TYPE:' question.)

  3) Press the MONITOR key to monitor
     the power line.   Your reports
     will be printed automatically.

(Press HELP! again for general infor-
mation on the six modes of operation.)
=====================================

=====================================
.ne PowerScope monitor can be in one
of six modes:

    1) Press the SETUP MENU key to
       program the Setup Menu.
       Use the up arrow and the down
       arrow key to work your way
       through the questions on the
       menu. The 'HELP!' key will
       always give you information
       on a question on the menu.
       (You may want to press 'HELP!'
       when you have selected the type
       of power line you are going to
       monitor. This will give you
       installation instructions.)

       By pressing the SETUP MENU key,
       then immediately pressing the
       UP ARROW key, you will enter
       the Key Operator Menu.  This
       menu will give you control of
       the detailed operation of the
       PowerScope.

    2) Press the STATUS key to print
       the Status Report.  This
       report tells you the present
       voltage, frequency, and noise
       on each of the channels.  This
       report can be especially
       useful when you're trying to
       set the thresholds correctly.
       It's also useful for checking
       to see if you've installed the
       monitor correctly.

    3) Press the REPORT MENU key to
       enter the Report menu.  Use
       the up arrow and the down
       arrow to work your way through
       the questions on the menu.
       The 'HELP!' key will always
       give you information on a
       question on the menu.

    4) Press the MONITOR key to start
       monitoring the power line.
       The PowerScope will print a
       complete copy of your setup,
       and show you the initial wave-
       shapes on each channel (if you
       have requested them in the
       Report Menu).  Then it will
       print a disturbance report
       every time a power disturbance
       occurs.

    5) Press the SELF CALIBRATE key
       to calibrate your PowerScope.
       The PowerScope has the ability
       to completely calibrate itself.
       A Calibration Report will be
       printed automatically, showing
       the calibration of all of the
       ranges on all of the channels.

    6) Press the SELF TEST key to test
       the PowerScope.

(There is no more HELP!)
```

Type: Ind. channels

Selections: Single Phase
Dual 1-phase
3 phase delta
3 phase wye
Ind. channels

Use the VALUE UP/VALUE DOWN keys to select independent channels.

Channel setup: 1

Selections: 1
2
3
4

Use the VALUE UP/VALUE DOWN keys to select which channel you will be setting thresholds for now.

Let's say you want to set up the thresholds for Channel 1 first.

HELP!

```
Select 'Ind. channels' (Independent
channels) if you want to setup each
channel individually.

You will be asked to name each of the
channels, and to specify what type of
measurement each channel will be used
for (AC, DC or NEUTRAL-GROUND). You
will also assign separate monitoring
thresholds for each of the channels.

(Press HELP! again for general
information on the Setup Menu.)
```

```
Use the VALUE UP/VALUE DOWN keys to
select which channel you will be
setting thresholds for now.

(Press HELP! again for more infor-
mation on answering this question).
```

Setup Menu, continued

AC

Mode: AC

Selections: AC
DC
NEUT-GND
OFF

Use the VALUE UP/VALUE DOWN keys to select a mode for this channel.

You have four choices:

AC - Monitors AC voltages, to detect impulses, sags, surges, waveshape faults, noise, and frequency errors.

DC - Monitors DC voltages, to detect impulses, sags, surges, and noise (but will not monitor for frequency errors).

NEUT-GND - Monitors neutral-to-ground voltages, to detect impulses, surges, and noise (but not sags, frequency errors, or waveshape faults).

OFF - Turns this channel off.

Let's say you choose AC monitoring for Channel 1.

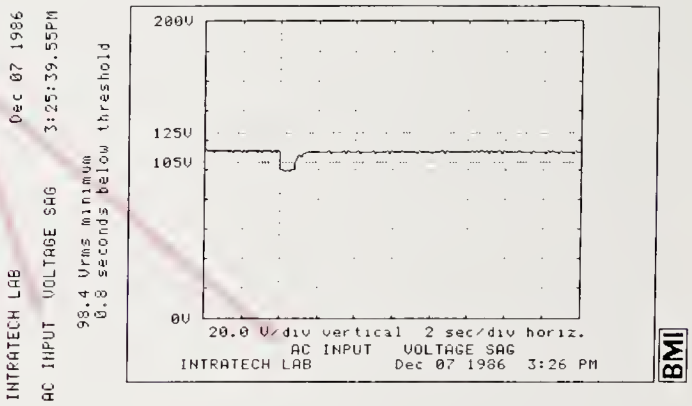
HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select a mode for this channel.

        You have four choices:

OFF -    Turns this channel off.

AC  -    Allows this channel to monitor
         AC voltages.  It will detect
         impulses, sags, surges,
         waveshape faults, noise, and
         frequency errors.

DC  -    Allows this channel to monitor
         DC voltages.  It will detect
         impulses, sags, surges, and
         noise (but will not monitor
         for frequency errors or
         waveshape faults).

NEUT/ -  Allows this channel to monitor
GND      neutral-to-ground voltages. It
         will detect impulses, surges,
         and noise (but will not
         monitor for sags, frequency
         errors, or waveshape faults).

(Press HELP! again for general infor-
mation on the Setup Menu).
```

Setup Menu, continued

AC

Name: AC INPUT



Use the number/letter keypad to name this channel.

Use the left and right arrow keys to move the flashing cursor.

Use the number keys to enter both letters and numbers; for example to enter the letter "A", press the 2ABC key 2 times. On the first press, a 2 will appear, on the second an A.

Now move the flashing cursor to the next position by pressing the right arrow key. Press the 0 SPACE button twice to enter a space. Press the down arrow key to go on to the next question.

HELP!

```
Enter up to 9 characters from the
keyboard to name this channel.

Use the left and right arrow keys to
move the flashing cursor.

Use the number keys to enter both
letters and numbers.  For example, to
enter the letter 'B', push the '2ABC'
key three times.   Then move the
flashing cursor to the next character.

It's a good idea to distinguish
each channel so it's immediately
recognizeable to you, e.g., VCC 5V
or VAX10V, or ROOM12B.

(Press HELP' again for general infor-
mation on the Setup Menu).
```

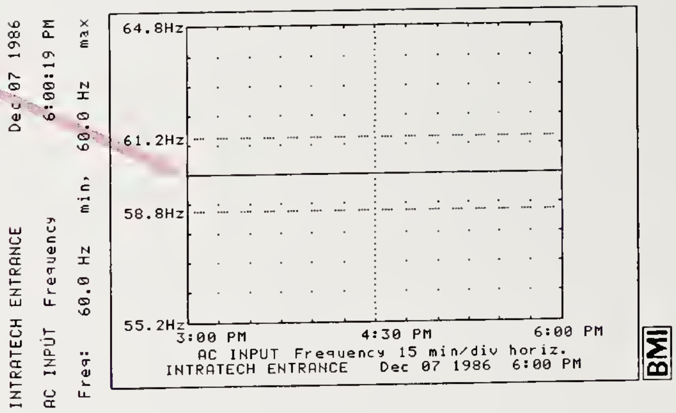
AC

Nom. freq.: 60.0Hz

Range: 45 Hz to 400 Hz

Use the number keys to enter the nominal frequency of the line you are monitoring.

Typical settings are
50.0 Hz, 60.0 Hz,
400.0 Hz, or
415.0 Hz.



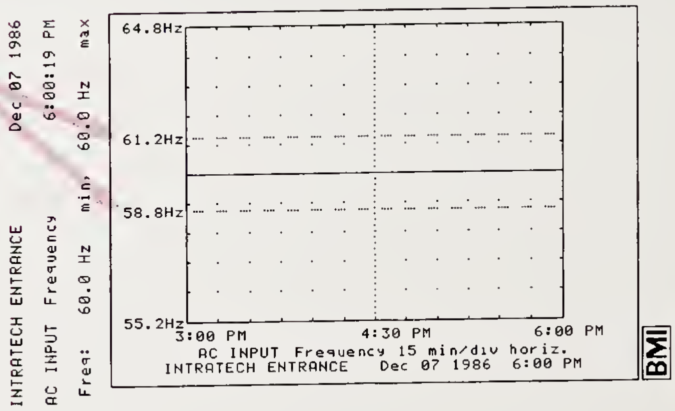
AC

Freq. tol.: 1.2Hz

Range: 0.4Hz to 135.0Hz

Use the number keys to enter a threshold for line-frequency deviation.

The range is 1% to 30% of the nominal frequency, and is entered in Hertz. A typical value is 2% of your nominal frequency.



For example, if the nominal frequency setting is 50.0 Hz,
the frequency tolerance range is .5 Hz (1%) to 15 Hz (30%).
If the frequency is 60.0 Hz, the frequency tolerance range is .6 Hz to 18 Hz.
If the frequency is 400.0 Hz, the frequency tolerance range is 4.0 Hz to 120 Hz.
If the frequency is 415.0 Hz, the frequency tolerance range is 4.15 Hz to 124.5 Hz.

HELP!

```
Enter the nominal line frequency of
the line you are monitoring.  This
provides a reference to the monitor
from which it can base its measure-
ments. Typical values are 50.0 Hz,
60.0 Hz, and 400.0 Hz.  The
acceptable range is 45.0 Hz to
450.0 Hz.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

```
Enter in Hertz the amount of line
frequency deviation from nominal that
you are willing to tolerate before the
PowerScope reports a disturbance. The
range is 0.2% to 50% of your nominal
frequency setting.   A typical value
is 2% of your nominal frequency.

For example, if your nominal
frequency setting is 60 Hz., the range
is 0.1 Hz (0.2%) to 30.0 Hz (50%).
The default setting for 60 Hz is
1.2 Hz (2%).

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued

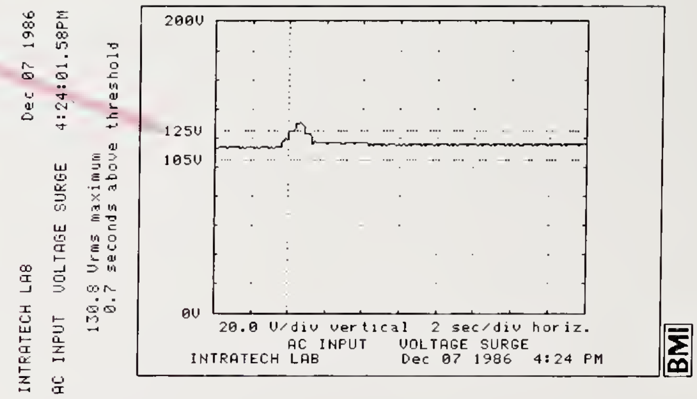
AC

Surge volt: 125.0Vrms

Range: 1.0 Vrms to 600 Vrms

Use the number keys to enter the high-voltage threshold for this AC probe.

The usual value is about 10% above the nominal voltage. The acceptable range is 1.0 Vrms to 600.0 Vrms. The surge-voltage threshold also determines the full-scale RMS voltage as follows:



Surge graph.

Voltage Surge Threshold Table

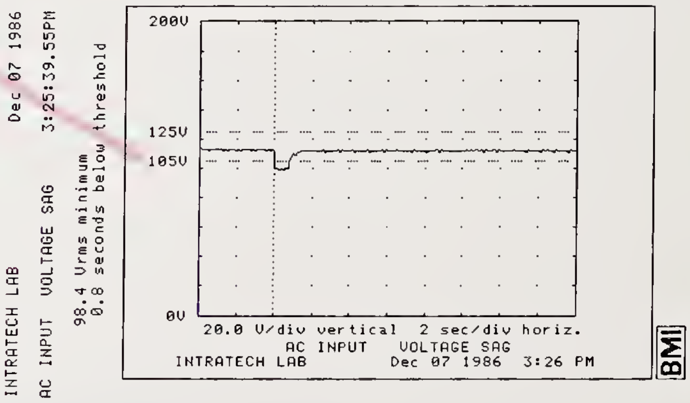
Surge Threshold	Full-Scale
1.0 – 6.2 Vrms	10.0 Vrms
6.3 – 12.5 Vrms	20.0 Vrms
12.6 – 25.0 Vrms	40.0 Vrms
25.1 – 62.5 Vrms	100.0 Vrms
62.6 - 125.0 Vrms	200.0 Vrms
125.1 - 166.5 Vrms	250.0 Vrms
166.6 - 250.0 Vrms	400.0 Vrms
250.1 - 600.0 Vrms	800.0 Vrms

Sag volt: 105.0Vrms

Range: 0.0 Vrms to 599 Vrms

Use the number keys to enter the low-voltage threshold.

The usual value is about 15% below the nominal voltage. The acceptable range is 0.0 to 599.0 Vrms.



Sag graph.

HELP!

```
Use the number keys to enter the
high voltage threshold.  The usual
value is about 10% above the nominal
voltage.  The acceptable range is
1.0 Vrms to 600.0 Vrms.

(Press HELP! again for general
information on the Setup Menu.)
```

```
Use the number keys to enter the low
voltage threshold.  The usual value is
about 15% below the nominal voltage.
The acceptable range is 0.0 Vrms to
599.9 Vrms.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

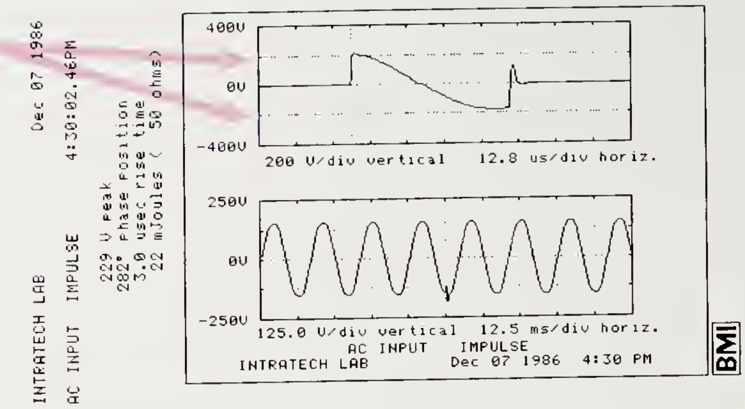
AC

Impulse thr: 200 Vpk

Range: 20 Vpk to 6000 Vpk

Use the number keys to enter the impulse threshold.

Typical thresholds are from 100 to 250 volts. You may select any value from 20 Vpk to 6000 Vpk.



Impulse graph.

HELP!

```
Use the number keys to enter the value
of the smallest impulse you wish the
PowerScope to report. Typical
thresholds are in the range of
100-250 volts.  You may select any
value from 20 to 6000 volts.

(Press HELP! again for more infor-
mation on answering this question.)
```

Setup Menu, continued

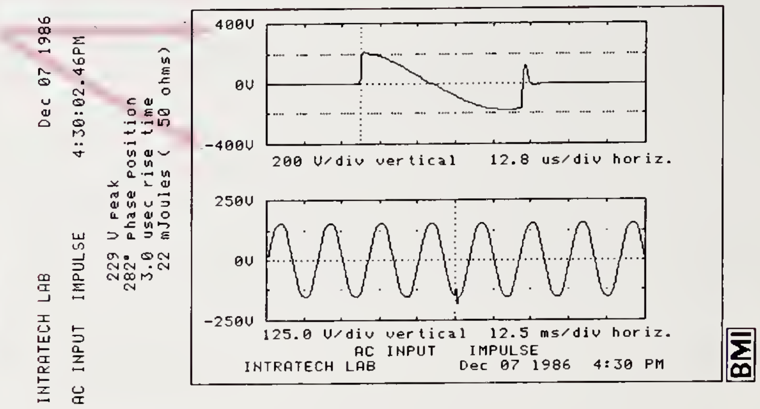
NOTE: The next question will only appear if you have Impulse Ranging in the Key Operator Menu set to MANUAL.

AC

Imp. range: 400 Vpk

Possible selections: See the following table.

Use the VALUE UP/ VALUE DOWN keys to select the full-scale impulse range for this AC probe.



Impulse graph.

The selections depend on the impulse threshold, e.g. for a 20 - 24 Vpk threshold, there are 2 full-scale ranges available, 100 or 200 volts full scale.

Manual Impulse Ranging Table

Impulse Threshold	Available Full-Scale Ranges
20-24 Vpk	+/- 100 or 200 volts full-scale
24-49 Vpk	+/- 100, 200 or 400 volts full-scale
50 Vpk	+/- 100, 200, 400 or 800 volts full-scale
51-99 Vpk	+/- 200, 400 or 800 volts full-scale
100 Vpk	+/- 200, 400, 800 or 1600 volts full-scale
101-199 Vpk	+/- 400, 800 or 1600 volts full-scale
200 Vpk	+/- 400, 800, 1600 or 3200 volts full-scale
201-399 Vpk	+/- 800, 1600 or 3200 volts full-scale
400 Vpk	+/- 800, 1600, 3200 or 6400 volts full-scale
401-800 Vpk	+/- 1600, 3200 or 6400 volts full-scale

If you selected AUTO Impulse Ranging in the Key Operator Menu (or plan to), the full-scale impulse range will be selected for you as follows:

Automatic Impulse Ranging Table

If Impulse Threshold selected in previous question is between...	The Impulse Range will set automatically to...
20 - 50 volts	+/- 100 volts
51 - 100 volts	+/- 200 volts
101 - 200 volts	+/- 400 volts
201 - 400 volts	+/- 800 volts
401 - 800 volts	+/- 1600 volts
801 - 1600 volts	+/- 3200 volts
1601- 6000 volts	+/- 6400 volts

HELP!

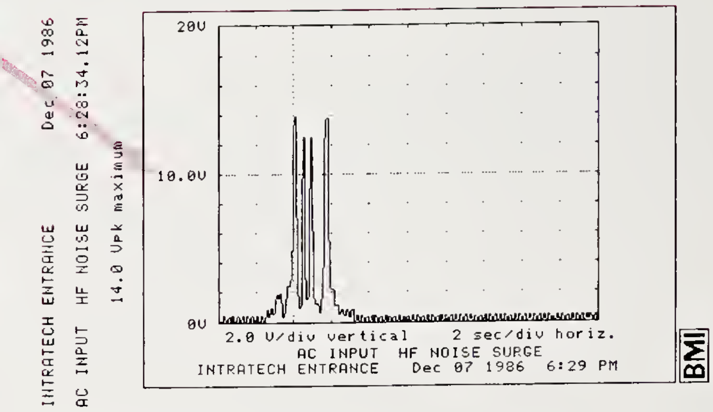
```
Use the VALUE UP/VALUE DOWN keys
to select the full scale impulse
range.  (If you want the PowerScope to
choose a range for you automatically,
use the Key Operator menu to select
AUTO impulse ranging.  The PowerScope
will automatically select a range that
will give you a good compromise
between resolution and dynamic range.)

(Press HELP! for more information on
selecting full scale ranges.)
```

Hi. freq. noise: 10.0V

Range: 1.0 V to 19.9 V

Use the number keys to enter the high-frequency noise disturbance threshold (measured in peak-to-peak volts).

A typical threshold is 5.0 Vpk. The acceptable range is 1.0 Vpk to 19.9 Vpk.



High-frequency noise disturbance graph.

HELP!

```
Use the number keys to enter the
high frequency noise disturbance
threshold (measured in peak-to-peak
volts).  A typical threshold is
5.0 Vpk.  The acceptable range is
1.0 Vpk to 19.9 Vpk.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued

Channel setup: 2

Selections: 1
2
3
4

Use the number/letter keypad to indicate which channel you will be setting thresholds for now.

We'll assume you will set thresholds for Channel 2 now.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select which channel you will be
setting thresholds for now.

(Press HELP! again for more infor-
mation on answering this question).
```

Setup Menu, continued

DC

Mode: DC

Selections: AC
DC
NEUT-GND
OFF

Use the VALUE UP/VALUE DOWN keys to select a mode for Channel 2.

Again, you have four choices. Let's assume that you want to monitor DC power on this channel.

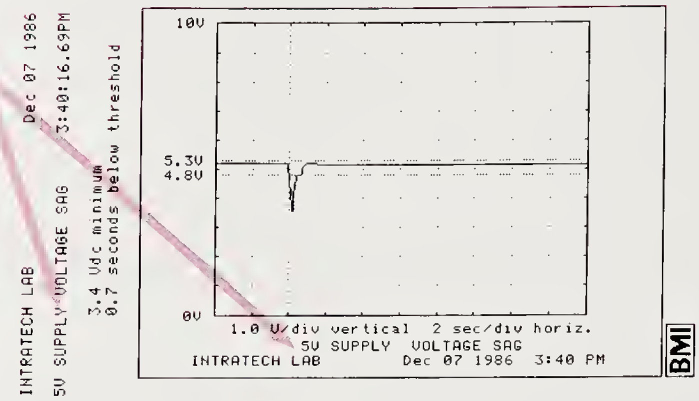
When monitoring DC, you must connect the more positive voltage to the red (positive) terminal.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select a mode for this channel.

        You have four choices:

OFF -    Turns this channel off.

AC  -    Allows this channel to monitor
         AC voltages.  It will detect
         impulses, sags, surges,
         waveshape faults, noise, and
         frequency errors.

DC  -    Allows this channel to monitor
         DC voltages.  It will detect
         impulses, sags, surges, and
         noise (but will not monitor
         for frequency errors or
         waveshape faults).

NEUT/ -  Allows this channel to monitor
GND      neutral-to-ground voltages. It
         will detect impulses, surges,
         and noise (but will not
         monitor for sags, frequency
         errors, or waveshape faults).

(Press HELP! again for general infor-
mation on the Setup Menu).
```

DC

Name: 5V SUPPLY



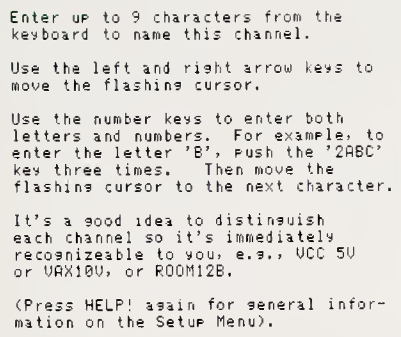
Use the number/letter keypad to name this channel.

The name can be up to 9 characters long. Let's say you want to call this DC channel “5V SUPPLY”.

To enter the number “5”, you would press the “5JKL” key once. To enter a “V”, you would press the “8TUV” key twice. On the first press, an 8 will appear, on the second press a T will appear, on the third a U, and on the fourth a V will appear.

Now move the flashing cursor to the next position by pressing the right arrow key. Press the 0 SPACE button twice to enter a space. Press the down arrow key to go on to the next question.

HELP!



```
Enter up to 9 characters from the
keyboard to name this channel.

Use the left and right arrow keys to
move the flashing cursor.

Use the number keys to enter both
letters and numbers.  For example, to
enter the letter 'B', push the '2ABC'
key three times.   Then move the
flashing cursor to the next character.

It's a good idea to distinguish
each channel so it's immediately
recognizeable to you, e.g., VCC 5V
or VAX10V, or ROOM12B.

(Press HELP! again for general infor-
mation on the Setup Menu).
```

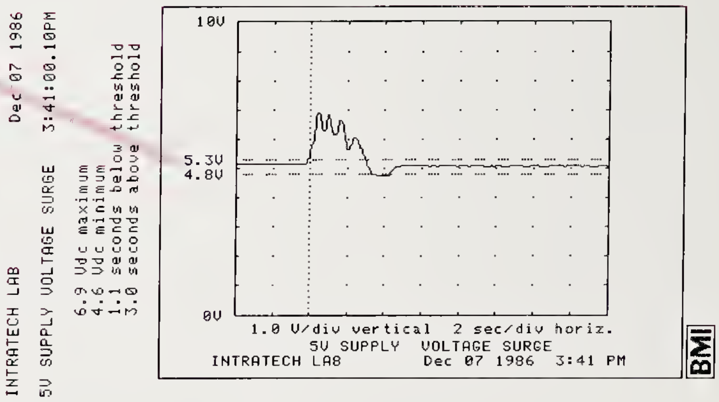
Setup Menu, continued

DC

Surge volt: 5.3Vdc

Range: 1.0 Vdc to 600 Vdc

Use the number keys to enter the high-voltage threshold for the DC line you are monitoring on Channel 2.



DC surge graph.

The usual value is about 10% above the nominal voltage. The acceptable range is 1.0 Vdc to 600.0 Vdc. The surge-voltage threshold also determines the full-scale RMS voltage as follows:

Voltage Surge Threshold Table

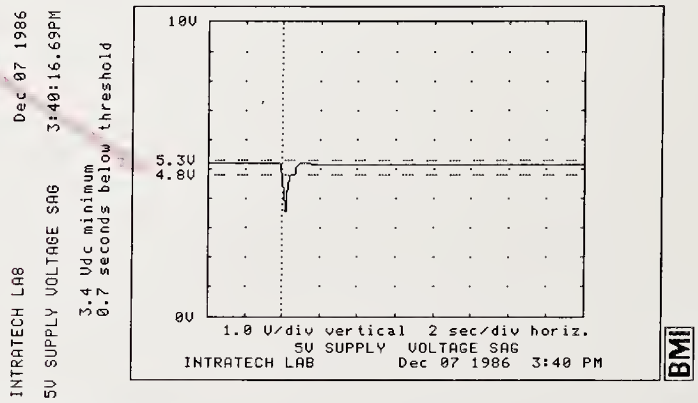
Surge Threshold	Full Scale
1.0 – 6.2 Vdc	10.0 Vdc
6.3 – 12.5 Vdc	20.0 Vdc
12.6 – 25.0 Vdc	40.0 Vdc
25.1 – 62.5 Vdc	100.0 Vdc
62.6 - 125.0 Vdc	200.0 Vdc
125.1 - 166.5 Vdc	250.0 Vdc
166.6 - 250.0 Vdc	400.0 Vdc
250.1 - 600.0 Vdc	800.0 Vdc

DC

Sag volt: 4.8Vdc

Range: 0.0 Vdc to 599.0 Vdc

Use the number keys to enter the low-voltage threshold.



DC sag graph.

The usual value is about 15% below the nominal voltage. The acceptable range is 0.0 to 599.0 Vdc.

HELP!

```
Use the number keys to enter the high
voltage threshold.

The usual value is about 10% above
the nominal voltage.   The acceptable
range is 1.0 Vdc to 600.0 Vdc.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

```
Use the number keys to enter the low
voltage threshold.   The usual value
is about 10% below  the nominal
voltage. The acceptable range is 0.0
to 599.0 Vdc.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued

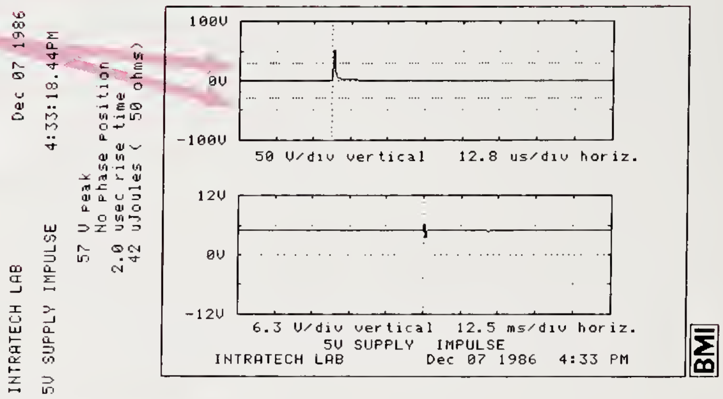
DC

Impulse thr: 30 Vpk

Range: 20 Vpk to 6000 Vpk

Use the number keypad to enter the impulse threshold.

Typical thresholds are from 100 to 250 Volts. You may select any value from 20 to 6000 volts peak.



```
INTRATECH LAB                    Dec 07 1986
5V SUPPLY IMPULSE                4:33:18.44PM
      57 V peak
       No Phase position
         2.0 usec rise time
         42 uJoules ( 50 ohms)
```

DC impulse graph.

HELP!

```
Use the number keys to enter the value
of the smallest impulse you wish the
PowerScope to report. Typical
thresholds are in the range of
100-250 volts.  You may select any
value from 20 to 6000 volts.

(Press HELP! again for more infor-
mation on answering this question.)
```

Setup Menu, continued

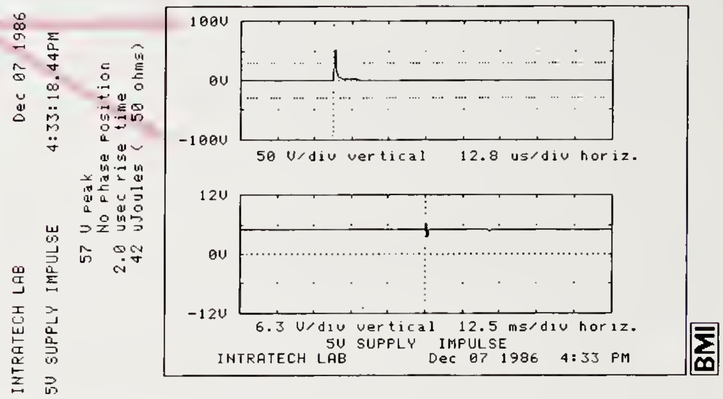
NOTE: The next question will only appear if you have Impulse Ranging in the Key Operator Menu set to MANUAL.

DC

Imp. range: 100 Vpk

Use the VALUE UP/ VALUE DOWN keys to select the full-scale impulse range.

The selections depend on the impulse threshold, e.g. for a 20-24 Vpk threshold, there are 2 full-scale ranges available, 100 or 200 volts full scale.



DC impulse graph.

Manual Impulse Ranging Table

Impulse Threshold	Available Full-Scale Ranges
20-24 Vpk	+/-100 or 200 volts full-scale
24-49 Vpk	+/-100, 200 or 400 volts full-scale
50 Vpk	+/-100, 200, 400 or 800 volts full-scale
51-99 Vpk	+/-200, 400 or 800 volts full-scale
100 Vpk	+/-200, 400, 800 or 1600 volts full-scale
101-199 Vpk	+/-400, 800 or 1600 volts full-scale
200 Vpk	+/-400, 800, 1600 or 3200 volts full-scale
201-399 Vpk	+/-800, 1600 or 3200 volts full-scale
400 Vpk	+/-800, 1600, 3200 or 6400 volts full-scale
401-800 Vpk	+/-1600, 3200 or 6400 volts full-scale

If you selected AUTO Impulse Ranging in the Key Operator Menu (or plan to), the full-scale impulse range will be selected for you as follows:

Automatic Impulse Ranging Table

Impulse Threshold	Full-Scale Range Set Automatically To...
20 - 50 volts	+/- 100 volts
51 - 100 volts	+/- 200 volts
101 - 200 volts	+/- 400 volts
201 - 400 volts	+/- 800 volts
401 - 800 volts	+/- 1600 volts
801 - 1600 volts	+/- 3200 volts
1601- 6000 volts	+/- 6400 volts

HELP!

```
Use the VALUE UP/VALUE DOWN keys
to select the full scale impulse
range.  (If you want the PowerScope to
choose a range for you automatically,
use the Key Operator menu to select
AUTO impulse ranging.  The PowerScope
will automatically select a range that
will give you a good compromise
between resolution and dynamic range.)

(Press HELP! for more information on
selecting full scale ranges.)
```

```
The full scale impulse ranges are:

 100 Vpk
 200 Vpk
 400 Vpk
 800 Vpk
1600 Vpk
3200 Vpk
6400 Vpk

To preserve resolution, the
PowerScope will not allow you to
select a full scale range that is
less than two times your impulse
threshold or greater than 16 times
your impulse threshold:

Full scale      Acceptable thresholds
----------      ---------------------
  100 Vpk           20 Vpk -    50 Vpk
  200 Vpk           20 Vpk -   100 Vpk
  400 Vpk           20 Vpk -   200 Vpk
  800 Vpk           50 Vpk -   400 Vpk
 1600 Vpk          100 Vpk -   800 Vpk
 3200 Vpk          200 Vpk -  1600 Vpk
 6400 Vpk          400 Vpk -  6000 Vpk

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

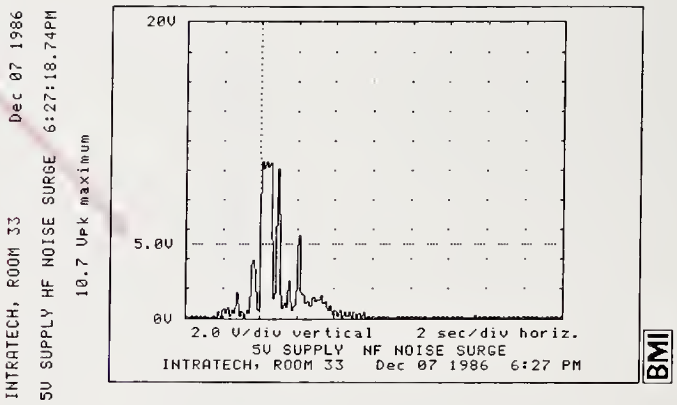
DC

Hi. freq. noise: 5.0V

Range: 1.0V to 19.9V

Use the number keys to enter the high-frequency noise disturbance threshold (measured in peak-to-peak volts).

A typical threshold is 5.0 Vpk. The acceptable range is 1.0 Vpk to 19.9 Vpk.



DC high-frequency noise disturbance graph.

Channel setup: 3

Selections: 1
2
3
4

Use the VALUE UP/VALUE DOWN keys to select which channel you will be setting thresholds for now.

Let's assume you choose Channel 3.

HELP!

```
Use the number keys to enter the
high frequency noise disturbance
threshold (measured in peak-to-peak
volts).  A typical threshold is
5.0 Vpk.  The acceptable range is
1.0 Vpk to 19.9 Vpk.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

```
Use the VALUE UP/VALUE DOWN keys to
select which channel you will be
setting thresholds for now.

(Press HELP! again for more infor-
mation on answering this question).
```

NEUT-GND

Mode: NEUT-GND

Selections: AC
DC
NEUT-GND
OFF

Use the VALUE UP/VALUE DOWN keys to select a mode for Channel 3.

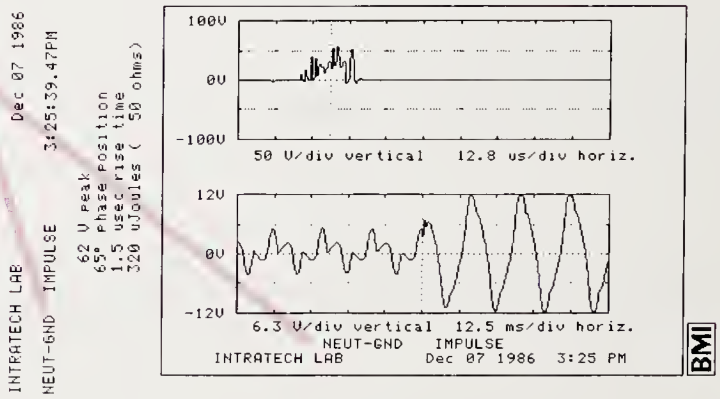
Let's assume that you want to monitor neutral-to-ground on this channel.

NEUT-GND

Name: NEUT-GND

Use the number/letter keypad to name this channel.

The name can be up to 9 characters long. Let's say you want to name this channel NEUT-GND.



Use the left and right arrow keys to move the flashing cursor.

Use the number keys to enter both letters and numbers; for example, to enter the letter “G”, press the 4GHI key 2 times. On the first press, a 4 will appear, on the second a G will appear.

Now move the flashing cursor to the next position by pressing the right arrow key. Press the 0 SPACE key twice to enter a space. Press the down arrow key to go on to the next question.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select a mode for this channel.

        You have four choices:

OFF -    Turns this channel off.

AC  -    Allows this channel to monitor
         AC voltages.  It will detect
         impulses, sags, surges,
         waveshape faults, noise, and
         frequency errors.

DC  -    Allows this channel to monitor
         DC voltages.  It will detect
         impulses, sags, surges, and
         noise (but will not monitor
         for frequency errors or
         waveshape faults).

NEUT/ -  Allows this channel to monitor
GND      neutral-to-ground voltages. It
         will detect impulses, surges,
         and noise (but will not
         monitor for sags, frequency
         errors, or waveshape faults).

(Press HELP! again for general infor-
mation on the Setup Menu).
```

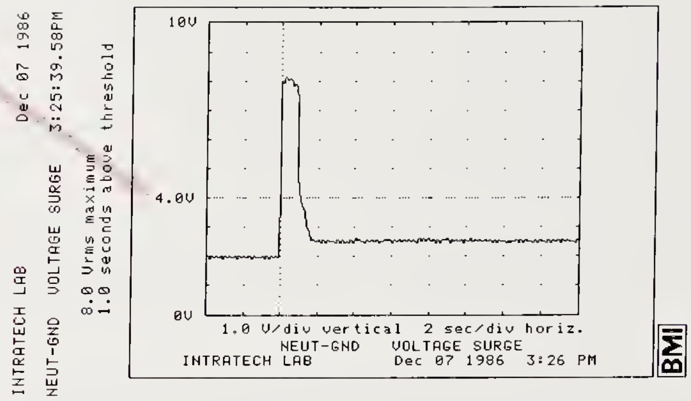
```
Enter up to 9 characters from the
keyboard to name this channel.

Use the left and right arrow keys to
move the flashing cursor.

Use the number keys to enter both
letters and numbers.  For example, to
enter the letter 'B', push the '2ABC'
key three times.   Then move the
flashing cursor to the next character.

It's a good idea to distinguish
each channel so it's immediately
recognizeable to you, e.g., VCC 5V
or VAX10V, or ROOM12B.

(Press HELP! again for general infor-
mation on the Setup Menu).
```

Setup Menu, continued

NEUT-GND

Surge volt: 4.0Vrms

Range: 1.0 Vrms to 600 Vrms



Neutral-to-ground surge graph.

Use the number keys to enter the high-voltage threshold.

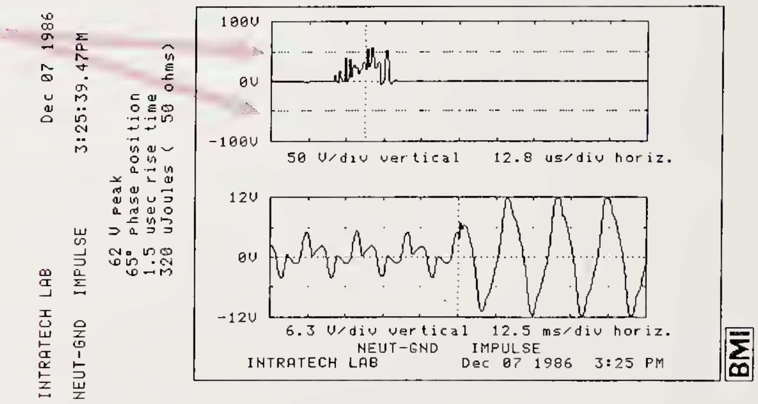
The usual value is about 10% above the nominal voltage. The acceptable range is 1.0 Vrms to 600.0 Vrms. The surge voltage threshold also determines the full-scale RMS voltage as follows:

Voltage Surge Threshold Table

Surge Threshold	Full Scale
1.0 – 6.2 Vrms	10.0 Vrms
6.3 – 12.5 Vrms	20.0 Vrms
12.6 – 25.0 Vrms	40.0 Vrms
25.1 – 62.5 Vrms	100.0 Vrms
62.6 - 125.0 Vrms	200.0 Vrms
125.1 - 166.5 Vrms	250.0 Vrms
166.6 - 250.0 Vrms	400.0 Vrms
250.1 - 600.0 Vrms	800.0 Vrms

NEUT-GND

Impulse thr: 50 Vpk



Neutral-to-ground impulse graph.

Use the number keypad to enter the impulse threshold.

Typical thresholds are from 100 to 250 volts. You may select any value from 20 to 6000 volts.

HELP!

Use the number keys to enter the high voltage threshold. The usual value is about 10% above the nominal voltage. The acceptable range is 1.0 Vrms to 600.0 Vrms.

(Press HELP! again for general information on the Setup Menu.)

Use the number keys to enter the value of the smallest impulse you wish the PowerScope to report. Typical thresholds are in the range of 100-250 volts. You may select any value from 20 to 6000 volts.

(Press HELP! again for more information on answering this question.)

If you choose AUTO impulse ranging in the Key Operator Menu, the PowerScope will choose a full scale impulse range according to the following table:

```
       Impulse                Impulse
      threshold              full scale
 --------------------       ----------
   20 Vpk -   50 Vpk          100 Vpk
   51 Vpk -  100 Vpk          200 Vpk
  101 Vpk -  200 Vpk          400 Vpk
  201 Vpk -  400 Vpk          800 Vpk
  401 Vpk -  800 Vpk         1600 Vpk
  801 Vpk - 1600 Vpk         3200 Vpk
 1601 Vpk - 6000 Vpk         6400 Vpk
```

However, if you choose MANUAL impulse ranging in the Key Operator Menu, you will be asked to select a full scale range yourself.

(Press HELP! again for general information on the Setup Menu.)

Setup Menu, continued

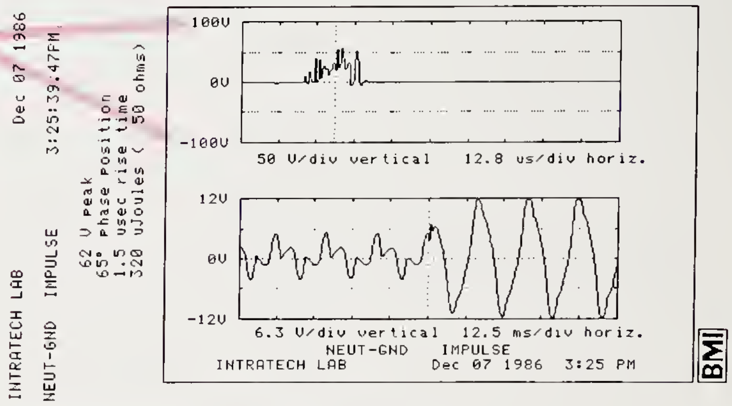
NOTE: You will only see this question if you have Impulse Ranging in the Key Operator Menu set to MANUAL.

NEUT-GND

Imp. range: 100 Vpk

Possible selections: See the following table.

Use the VALUE UP/ VALUE DOWN keys to select the full-scale impulse range for neutral-to-ground.



```
INTRATECH LAB       Dec 07 1986
NEUT-GND  IMPULSE   3:25:39.47PM
  62 V peak
 65° phase position
 1.5 usec rise time
 320 uJoules ( 50 ohms)
```

Neutral-to-ground impulse graph.

The selections depend on the impulse threshold, e.g. for a 20-24 Vpk threshold, there are 2 full-scale ranges available, 100 or 200 volts full scale.

Manual Impulse Ranging Table

Impulse Threshold	Available Full-Scale Ranges
20-24 Vpk	+/-100 or 200 volts full-scale
24-49 Vpk	+/-100, 200 or 400 volts full-scale
50 Vpk	+/-100, 200, 400 or 800 volts full-scale
51-99 Vpk	+/-200, 400 or 800 volts full-scale
100 Vpk	+/-200, 400, 800 or 1600 volts full-scale
101-199 Vpk	+/-400, 800 or 1600 volts full-scale
200 Vpk	+/-400, 800, 1600 or 3200 volts full-scale
201-399 Vpk	+/-800, 1600 or 3200 volts full-scale
400 Vpk	+/-800, 1600, 3200 or 6400 volts full-scale
401-800 Vpk	+/-1600, 3200 or 6400 volts full-scale

If you selected AUTO Impulse Ranging in the Key Operator Menu (or plan to), the full-scale impulse range will be selected for you as follows:

Automatic Impulse Ranging Table

Impulse Threshold	Full-Scale Range Set Automatically To...
20 - 50 volts	+/- 100 volts
51 - 100 volts	+/- 200 volts
101 - 200 volts	+/- 400 volts
201 - 400 volts	+/- 800 volts
401 - 800 volts	+/- 1600 volts
801 - 1600 volts	+/- 3200 volts
1601- 6000 volts	+/- 6400 volts

HELP!

```
Use the VALUE UP/VALUE DOWN keys
to select the full scale impulse
range.  (If you want the PowerScope to
choose a range for you automatically,
use the Key Operator menu to select
AUTO impulse ranging.  The PowerScope
will automatically select a range that
will give you a good compromise
between resolution and dynamic range.)

(Press HELP! for more information on
selecting full scale ranges.)
```

```
The full scale impulse ranges are:

100 Vpk
200 Vpk
400 Vpk
800 Vpk
      1600 Vpk
      3200 Vpk
      6400 Vpk

To preserve resolution, the
PowerScope will not allow you to
select a full scale range that is
less than two times your impulse
threshold or greater than 16 times
your impulse threshold:

Full scale      Acceptable thresholds
----------      ---------------------
  100 Vpk          20 Vpk -    50 Vpk
  200 Vpk          20 Vpk -   100 Vpk
  400 Vpk          20 Vpk -   200 Vpk
  800 Vpk          50 Vpk -   400 Vpk
 1600 Vpk         100 Vpk -   800 Vpk
 3200 Vpk         200 Vpk -  1600 Vpk
 6400 Vpk         400 Vpk -  6000 Vpk

(Press HELP! again for general infor-
  tion on the Setup Menu.)
```

Setup Menu, continued

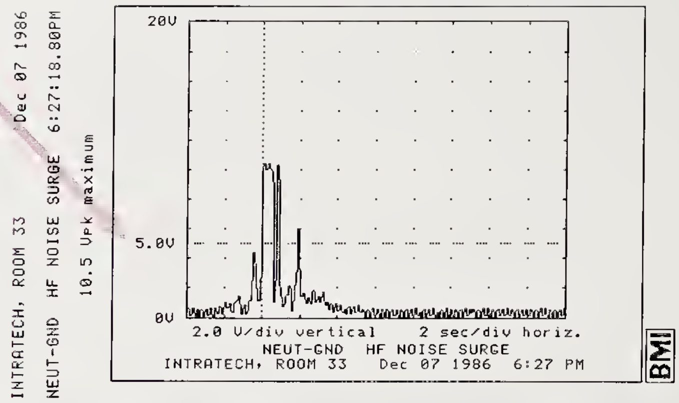
NEUT-GND

Hi. freq. noise: 5.0V

Range: 1.0V to 19.9V

Use the number keys to enter the high-frequency noise disturbance threshold (measured in peak-to-peak volts).

A typical threshold is 5.0 Vpk. The acceptable range is 1.0 Vpk to 19.9 Vpk.



Neutral-to-ground high-frequency noise disturbance graph.

HELP!

```
Use the number keys to enter the
high frequency noise disturbance
threshold (measured in peak-to-peak
volts).  A typical threshold is
5.0 Vpk.  The acceptable range is
1.0 Vpk to 19.9 Vpk.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Channel setup: 4

Selections: 1
2
3
4

Use the VALUE UP/VALUE DOWN keys to select which channel you will be setting thresholds for now.

You select Channel 4.

Off

Mode: OFF

Selections: AC
DC
NEUT-GND
OFF

Use the VALUE UP/VALUE DOWN keys to select a mode for this channel.

You turn Channel 4 off.

NOTE: If you are using probes for environmental monitoring there will be additional questions. See Chapter 6 (page 258) for an explanation of environmental thresholds.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select which channel you will be
setting thresholds for now.

(Press HELP! again for more infor-
mation on answering this question).
```

```
Use the VALUE UP/VALUE DOWN keys to
select a mode for this channel.

       You have four choices:

OFF -   Turns this channel off.

AC  -   Allows this channel to monitor
        AC voltages.  It will detect
        impulses, sags, surges,
        waveshape faults, noise, and
        frequency errors.

DC  -   Allows this channel to monitor
        DC voltages.  It will detect
        impulses, sags, surges, and
        noise (but will not monitor
        for frequency errors or
        waveshape faults).

NEUT/ - Allows this channel to monitor
GND     neutral-to-ground voltages. It
        will detect impulses, surges,
        and noise (but will not
        monitor for sags, frequency
        errors, or waveshape faults).
```

The Report Menu lets you choose the graphs and summary reports your PowerScope prints. For a complete discussion of graphs and summary reports, see Appendix E.

Quick Guide

1. Press the REPORT MENU key.

2. Use the VALUE UP/VALUE DOWN keys to answer the questions in the menu.

3. Press the down arrow to go to the next question.

4. Press the HELP! key if you want further explanation about the questions.

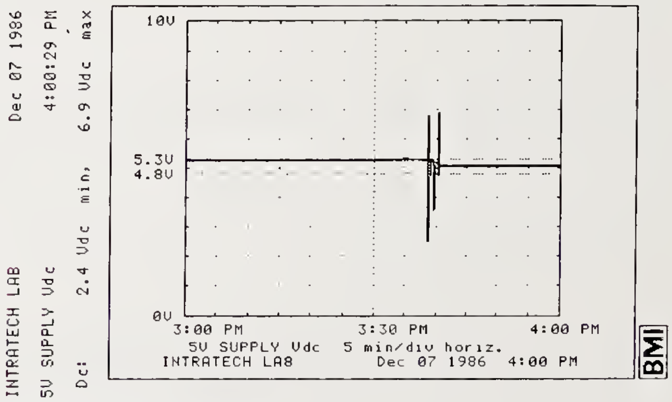
Press the REPORT MENU key now.

If you get the following message in the display, it's because the PowerScope has strip charts from the previous monitoring period.

Summary rpts: Print

Selections: Print
Clear

Use the VALUE UP/ VALUE DOWN keys to choose whether you want the pending strip charts.



Summary strip chart.

If you want them printed then erased, position PRINT in the display, then press the down arrow. If you want them erased immediately, position CLEAR in the display, then press the down arrow.

Then press the REPORT MENU key again and proceed.

HELP!

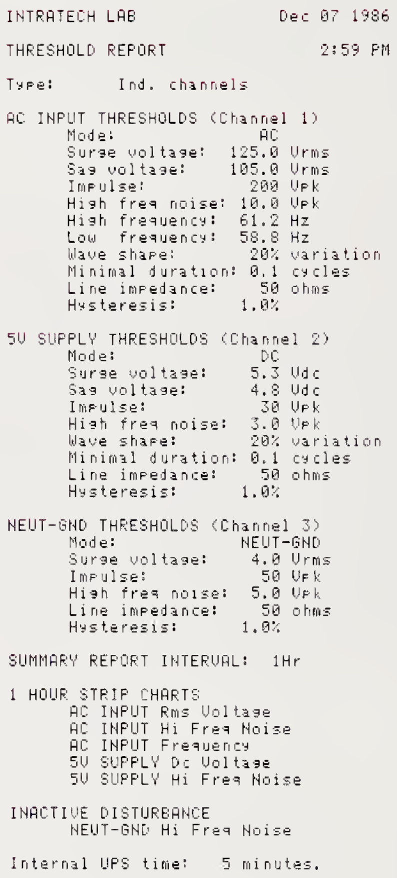
```
Use the VALUE UP/VALUE DOWN keys to
select PRINT or CLEAR and then
use the DOWN ARROW key to enter
the menu you have selected.

If you select PRINT, the summary data
and strip charts that have been
gathered so far by the PowerScope will
be printed and then reset. If you
select CLEAR, all of the summary
data and strip charts will be reset
without printing.

If you don't want to lose any summary
data, you may return to the Monitor
mode by pressing the MONITOR key.
```

Threshold report: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn the Threshold Report on or off.

Your PowerScope prints the Threshold Report after you press the MONITOR key. The Threshold Report shows all the current settings. Generally, you should leave the Threshold report on.



```
INTRATECH LAB                    Dec 07 1986

THRESHOLD REPORT                     2:59 PM

Type:       Ind. channels

AC INPUT THRESHOLDS (Channel 1)
      Mode:                 AC
      Surge voltage:   125.0 Vrms
      Sag voltage:     105.0 Vrms
      Impulse:           200 Vpk
      High freq noise:  10.0 Vpk
      High frequency:   61.2 Hz
      Low  frequency:   58.8 Hz
      Wave shape:        20% variation
      Minimal duration: 0.1 cycles
      Line impedance:     50 ohms
      Hysteresis:       1.0%

5V SUPPLY THRESHOLDS (Channel 2)
      Mode:                 DC
      Surge voltage:     5.3 Vdc
      Sag voltage:       4.8 Vdc
      Impulse:            30 Vpk
      High freq noise:   3.0 Vpk
      Wave shape:        20% variation
      Minimal duration: 0.1 cycles
      Line impedance:     50 ohms
      Hysteresis:       1.0%

NEUT-GND THRESHOLDS (Channel 3)
      Mode:             NEUT-GND
      Surge voltage:     4.0 Vrms
      Impulse:            50 Vpk
      High freq noise:   5.0 Vpk
      Line impedance:     50 ohms
      Hysteresis:       1.0%

SUMMARY REPORT INTERVAL:  1Hr

1 HOUR STRIP CHARTS
      AC INPUT Rms Voltage
      AC INPUT Hi Freq Noise
      AC INPUT Frequency
      5V SUPPLY Dc Voltage
      5V SUPPLY Hi Freq Noise

INACTIVE DISTURBANCE
      NEUT-GND Hi Freq Noise

Internal UPS time:   5 minutes.
```

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
turn the Threshold Report on or off.
This report should normally be left
on.

(Press HELP! again for more infor-
mation on Threshold Reports).

======================================

======================================

The usual sequence for operating
the PowerScope monitor is:

  1) Press the SETUP MENU key and
     answer the questions.
     To go on to the next question,
     press the Down Arrow.

  2) Connect the monitor to the
     power line. (See the HELP!
     message in the Setup Menu
     for the 'TYPE:' question.)

  3) Press the MONITOR key to monitor
     the power line.  Your reports
     will be printed automatically.

(Press HELP! again for general infor-
mation on the six modes of operation.)
```

```
The Threshold Report is the list of
thresholds and settings your
PowerScope can print automatically
before it begins monitoring.

(If you turn the Threshold Report
on now, you can still omit it when
you begin monitoring by pressing
the MONITOR key followed immediately
by the UP ARROW key.)

(Press HELP! again for general infor-
mation on the Report Menu).

======================================

======================================

The PowerScope monitor can be in one
of six modes:

   1) Press the SETUP MENU key to
      program the Setup Menu.
      Use the up arrow and the down
      arrow key to work your way
      through the questions on the
      menu. The 'HELP!' key will
      always give you information
      on a question on the menu.
      (You may want to press 'HELP!'
      when you have selected the type
      of power line you are going to
      monitor. This will give you
      installation instructions.)

      By pressing the SETUP MENU key,
      then immediately pressing the
      UP ARROW key, you will enter
      the Key Operator Menu.  This
      menu will give you control of
      the detailed operation of the
      PowerScope.

   2) Press the STATUS key to print
      the Status Report.  This
      report tells you the present
      voltage, frequency, and noise
      on each of the channels.  This
      report can be especially
      useful when you're trying to
      set the thresholds correctly.
      It's also useful for checking
      to see if you've installed the
      monitor correctly.

   3) Press the REPORT MENU key to
      enter the Report menu.  Use
      the up arrow and the down
      arrow to work your way through
      the questions on the menu.
      The 'HELP!' key will always
      give you information on a
      question on the menu.

   4) Press the MONITOR key to start
      monitoring the power line.
      The PowerScope will print a
      complete copy of your setup,
      and show you the initial wave-
      shapes on each channel (if you
      have requested them in the
      Report Menu).  Then it will
      print a disturbance report
      every time a power disturbance
      occurs.

   5) Press the SELF CALIBRATE key
      to calibrate your PowerScope.
      The PowerScope has the ability
      to completely calibrate itself.
      A Calibration Report will be
      printed automatically, showing
      the calibration of all of the
      ranges on all of the channels.

   6) Press the SELF TEST key to test
      the PowerScope.

   -re is no more HELP!)
```

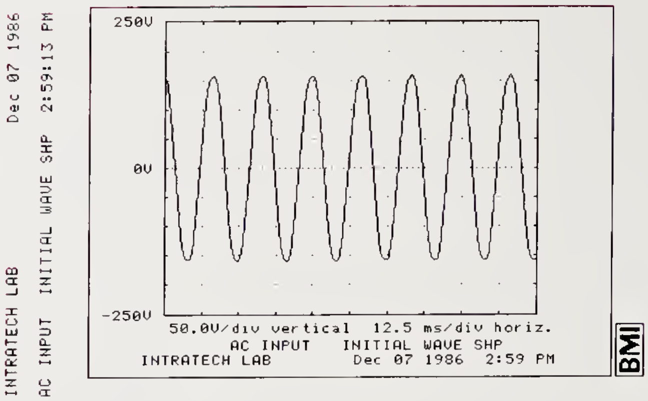
```
The Report Menu contains questions
that define the type of summary strip
charts you would like, and over what
time duration you would like them.

The questions in the Report Menu
vary depending on the type of power
each channel is monitoring, and if
you have probes plugged into the
environmental channels.

(Press HELP! again for general
information on the operating
sequence.
```

Report Menu, continued

Initial waves: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn the initial waveshape graphs on or off.



Your PowerScope prints initial waveshape graphs after the Threshold Report. These graphs show the initial condition of the sine waves. Generally, you should leave these graphs on.

HELP!

Use the VALUE UP/VALUE DOWN keys to turn the Initial Waveshape Report on or off. This report should normally be left on.

(Press HELP! again for more information on the Initial Waveshape Report).

The Initial Waveshape Report shows the condition of the sine waves at the beginning of the monitoring session. Initial waveshapes may give you additional information on the condition of the power lines.

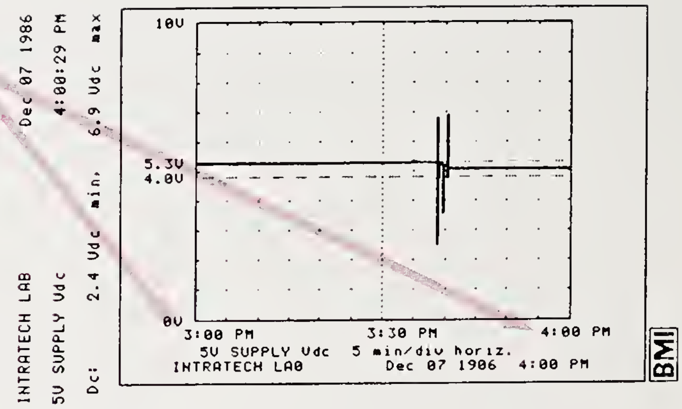
(Press HELP! again for general information on the Report Menu).

Report Menu, continued

Strip charts: 1 Hr

Selections: 24 Hr
12 Hr
6 Hr
3 Hr
1 Hr
Off

Use the VALUE UP/ VALUE DOWN keys to select the strip chart interval.



1-Hr strip chart.

```
INTRATECH LAB  6              Dec 07 1986

STRIP CHART REPORT                4:00 PM
 From  3:00 PM  To  4:00 PM

AC INPUT   (Channel 1)
 Rms:     78.2 Vrms min, 116.7 Vrms max
 Noise:    0.1 Vpk  min,   0.9 Vpk  max
 Freq:    60.0 Hz   min,  60.0 Hz   max
 Imp:          0 counted

5V SUPPLY  (Channel 2)
 Dc:       4.3 Vdc  min,   6.6 Vdc  max
 Noise:    0.7 Vpk  min,   1.4 Vpk  max
 Imp:          0 counted

NEUT-GND   (Channel 3)
 Rms:      0.1 Vrms min,   0.1 Vrms max
 Noise:    1.1 Vpk  min,   1.5 Vpk  max
 Imp:          0 counted
```

Strip chart summary report.

If you select:

24 hr–strip charts will be printed every 24 hours at midnight.
12 hr–strip charts will be printed every 12 hours beginning at 12:00.
6 hr–strip charts will be printed every 6 hours beginning at 6:00.
3 hr–strip charts will be printed every 3 hours beginning at 3:00.
1 hr–strip charts will be printed every hour on the hour.
Off–no long-term summary information will be printed.

NOTE: Whatever strip chart interval you choose here will appear in the forthcoming questions.

HELP!

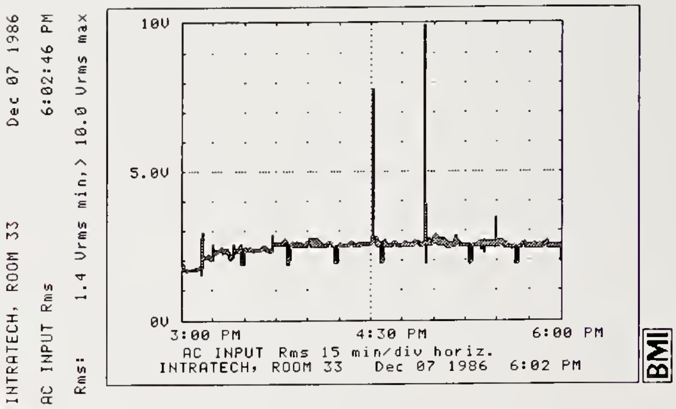
```
Use the VALUE UP/VALUE DOWN keys to
select the time interval between
printing strip charts and summary
reports.

Possible selections are: 24 hours,
12 hours, 6 hours, 3 hours, 1 hour,
or OFF.  The interval that you choose
impacts the choices offered you in the
next series of questions.

(Press HELP! for more information on
selecting strip chart summary
reports).
```

```
If you choose, for example, 12-hour
strip chart summaries, your choices
in the next questions regarding
individual strip chart summary reports
will include 12-hour strip charts.
(If you choose 3-hour strip charts
here, your choices in the next
questions will include 3-hour strip
charts, and so on.)

(Press HELP! for general information
on the Setup Menu.)
```

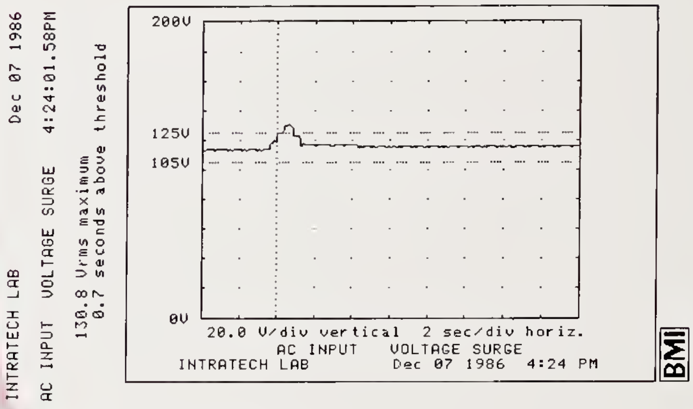
AC INPUT Rms: Both

Selections:
- Both
- 3 Hr
- Graph
- Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the Rms signal on the AC line you are monitoring using Channel 1 (named AC INPUT).



3-Hr strip chart: Rms.



Graph: Rms disturbance.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

3-Hr - (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above, (3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

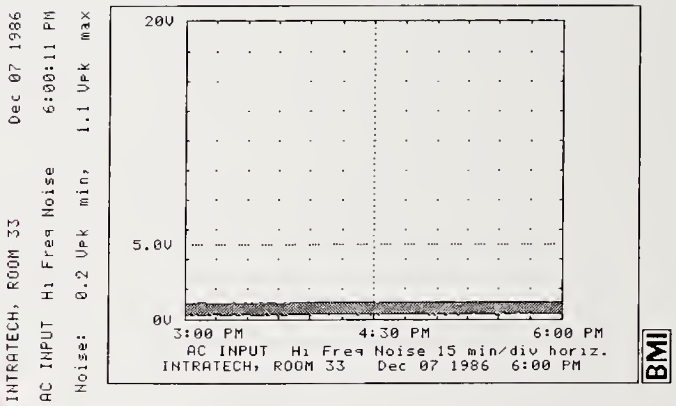
If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

(Press HELP! again for general information on the Report Menu.)

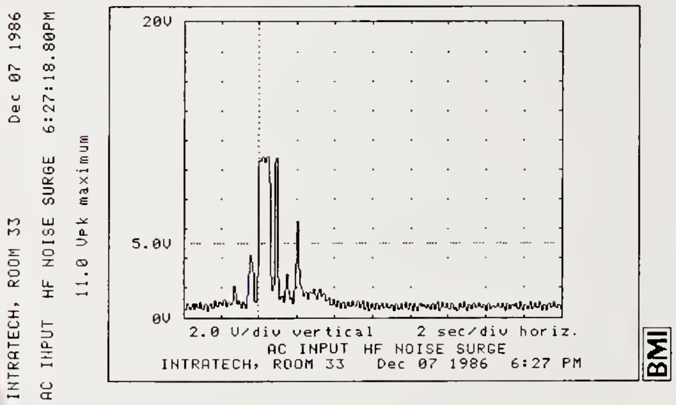
AC INPUT HFN: Both

Selections: Both
3 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the high-frequency noise signal.



3-Hr strip chart: high-frequency noise.



Graph: high-frequency noise.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

3-Hr - (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

(Press HELP! again for general information on the Report Menu.)

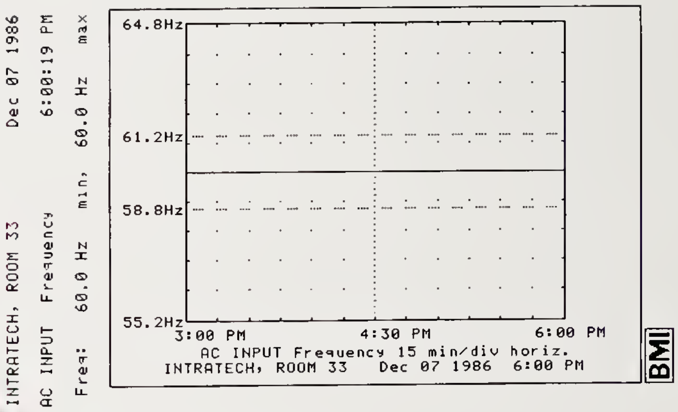
Report Menu, continued

AC

AC INPUT Freq: Both

Selections: Both
3 Hr
Text
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the frequency signal.



3-Hr strip chart: frequency.

```
INTRATECH, ROOM 33          Dec 07 1986
AC INPUT  LOW FREQ.     6:44:14.08PM
     Frequency below:        58.8 Hz

---------------------------------------
INTRATECH, ROOM 33          Dec 07 1986
AC INPUT  LOW FREQ END  6:44:18.21PM
     Minimum frequency:     57.9Hz
```

Text report: frequency disturbance.

If you choose:

Both - your PowerScope will print both strip charts and text reports.

3-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance text reports.

Text - your PowerScope will print disturbance text reports of this signal, but won't print strip charts.

Off - no disturbance text reports or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above, (3) TEXT, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a textual disturbance reports of this signal.

If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance reports.

If you choose TEXT, your PowerScope will print a textual report of all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither textual reports nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of strip chart summaries in this question.

(Press HELP! again for general information on the Report Menu.)

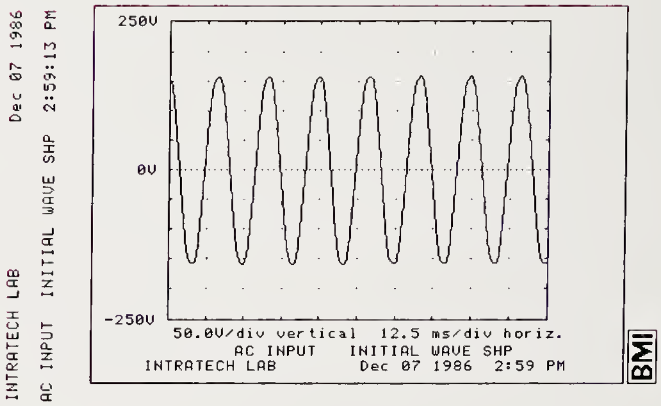
Report Menu, continued

AC

AC INPUT WAVE: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn waveshape fault graphs on or off.



HELP!

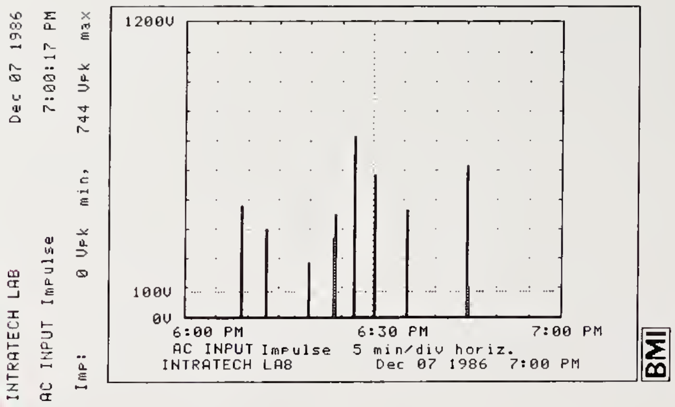
```
Use the VALUE UP/VALUE DOWN keys to
turn on or off the Waveshape fault
disturbance reporting for this signal.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

AC

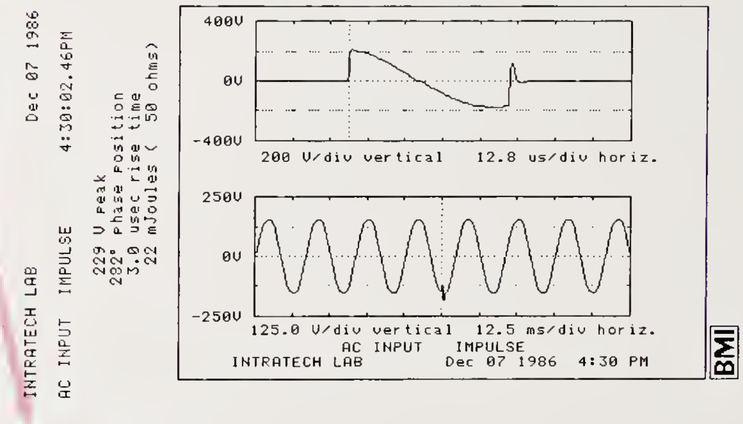
AC INPUT Imp: Both

Selections:
- Both
- 1 Hr
- Graph
- Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for impulses.



1-Hr strip chart: impulse.



Graph: impulse.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr - (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the maximum reading of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

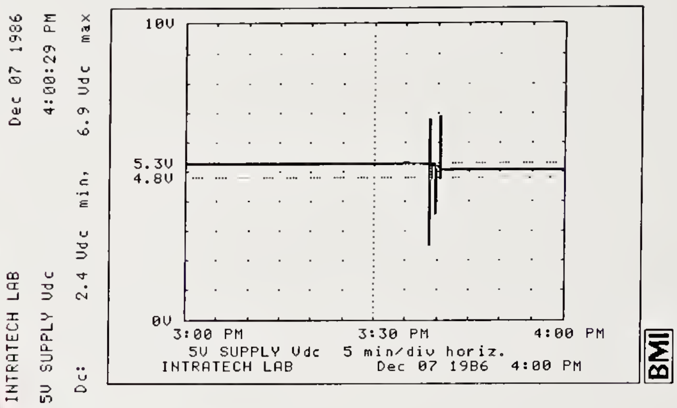
(Press HELP! again for general information on the Report Menu.)

DC

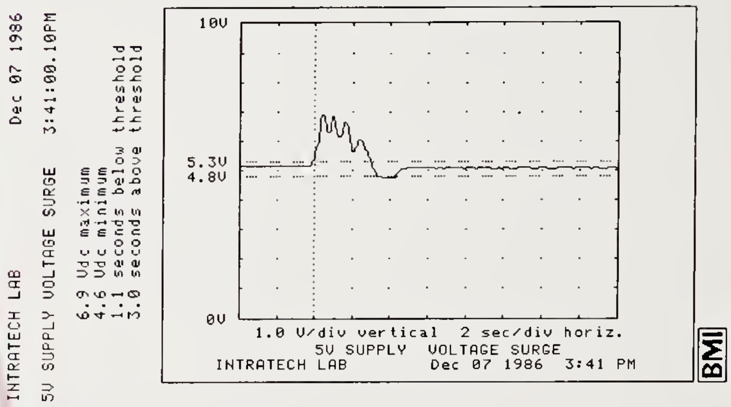
5V SUPPLY Vdc: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for DC voltage.



1-Hr strip chart: Vdc.



Graph: DC surge disturbance.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr - (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

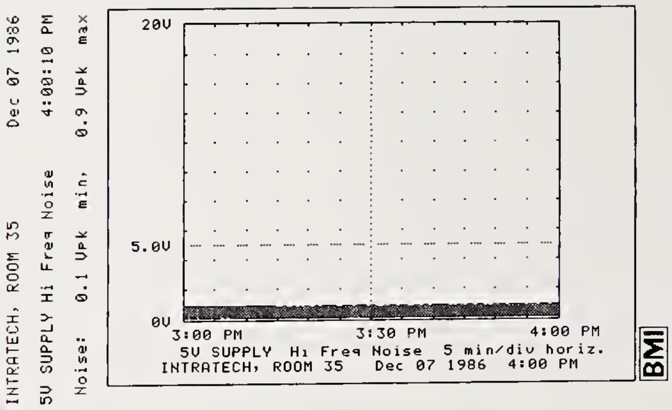
HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a disturbance graph of this
signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance graphs.

If you choose GRAPH, your PowerScope
will graph all disturbances for this
signal but will not print a strip
chart for this signal.

If you choose OFF, your PowerScope
will print neither disturbance graphs
nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu, you
will not have the choice of a strip
chart summary in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

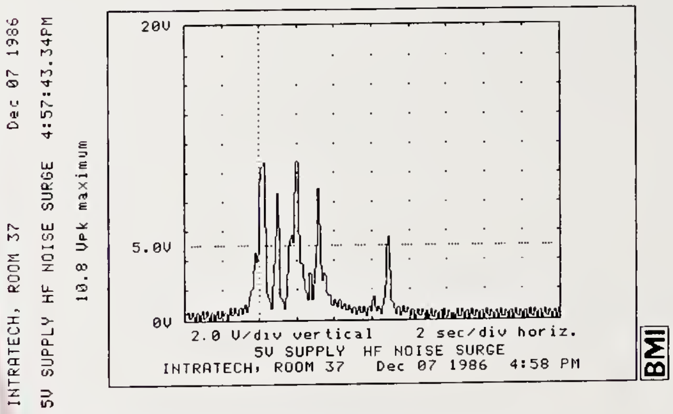
5V SUPPLY HFN: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the high-frequency noise signal.



1-Hr strip chart: high-frequency noise.



Graph: high-frequency noise disturbance.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr - (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a disturbance graph of this
signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance graphs.

If you choose GRAPH, your PowerScope
will graph all disturbances for this
signal but will not print a strip
chart for this signal.

If you choose OFF, your PowerScope
will print neither disturbance graphs
nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu, you
will not have the choice of a strip
chart summary in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

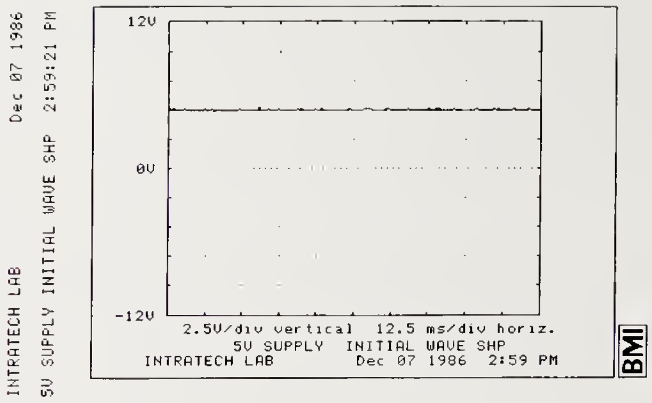
Report Menu, continued

DC

5V SUPPLY Wave: On

Selections: On
Off

Use the VALUE UP/ VALUE DOWN keys to turn the DC waveshape fault graphs on or off.



DC waveshape fault graph.

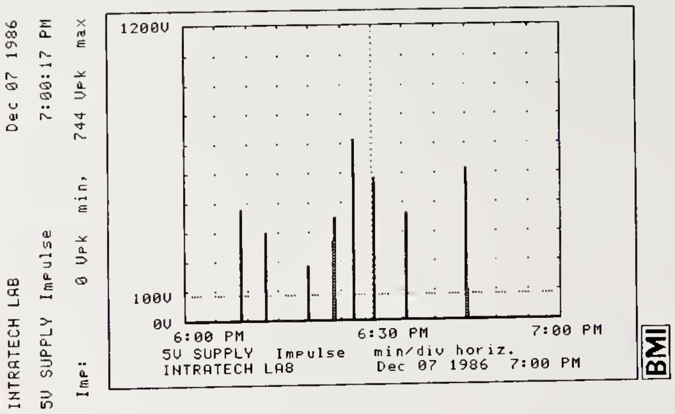
HELP!

```
Use the VALUE UP/VALUE DOWN keys to
turn on or off the Waveshape fault
disturbance reporting for this signal.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

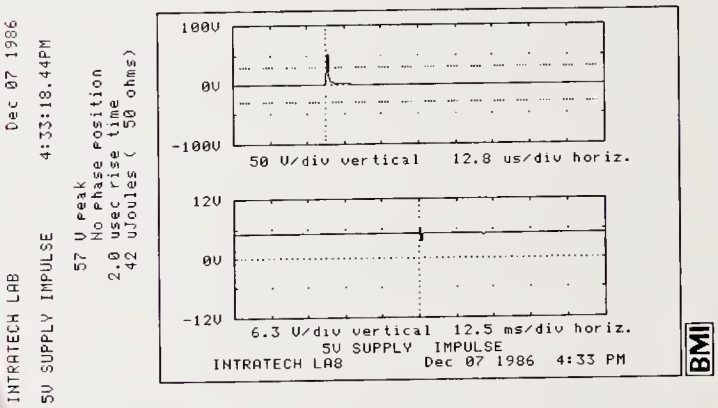
5V SUPPLY Imp: Both

Selections:	Both 1 Hr Graph Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for impulses.



1-Hr strip chart: Impulse .



Graph: impulse.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr - (1,3,6,12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal however the maximum reading of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above, (3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

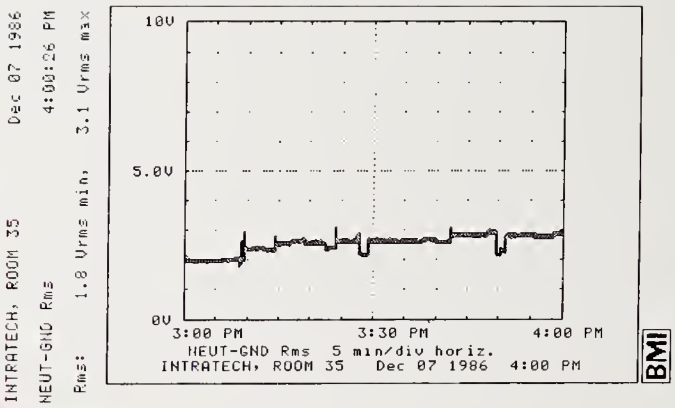
(Press HELP! again for general information on the Report Menu.)

N-G

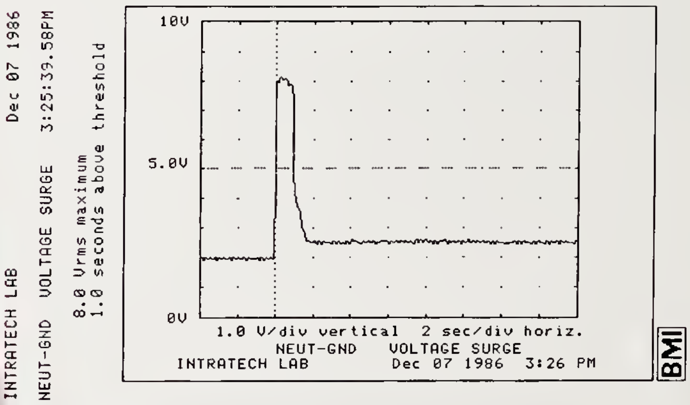
NEUT-GND Rms: Both

Selections:	Both
	1 Hr
	Graph
	Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the Rms signal on the neutral-to-ground line you are monitoring.



1-Hr strip chart: neutral-to-ground Rms.



Disturbance graph: neutral-to-ground surge.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr - (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

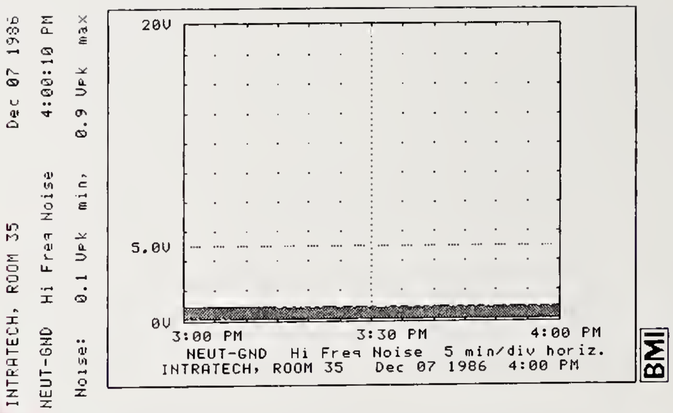
(Press HELP! again for general information on the Report Menu.)

N-G

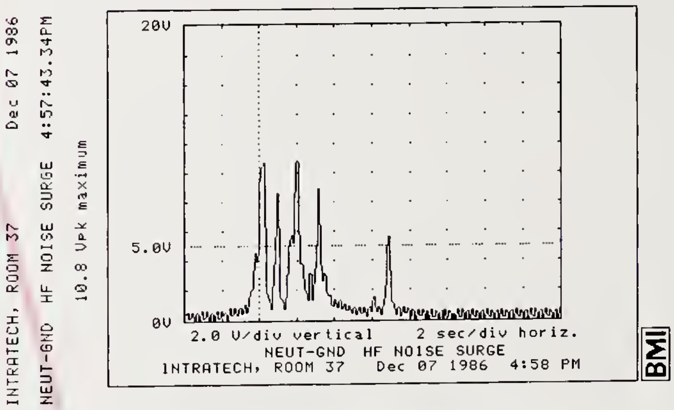
NEUT-GND HFN: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the neutral-to-ground high-frequency noise signal.



1-Hr strip chart: neutral-to-ground high-frequency noise.



Graph: neutral-to-ground high-frequency noise.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr - (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the minimum and maximum readings of this signal will be reported textually in the summary reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

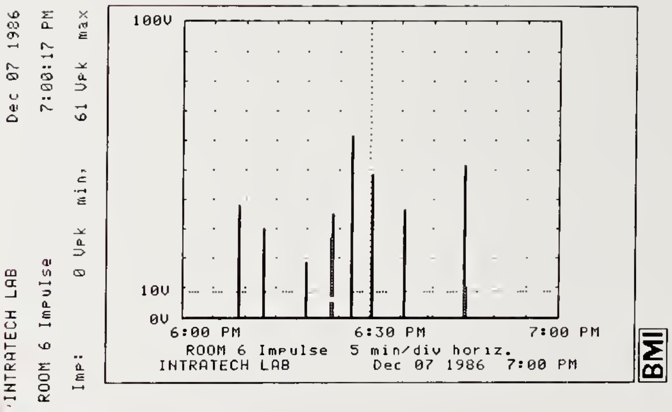
(Press HELP! again for general information on the Report Menu.)

N-G

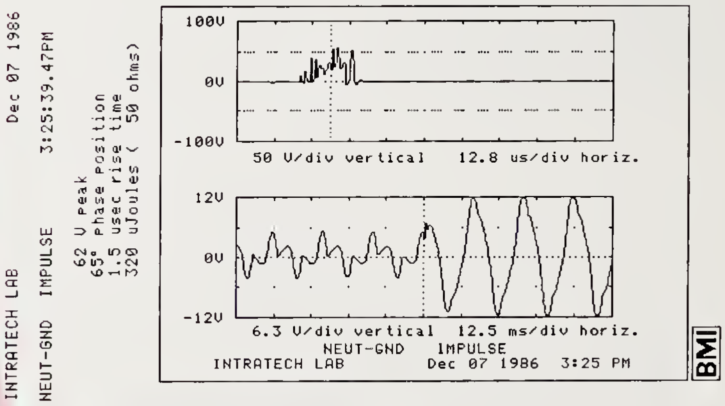
NEUT-GND Imp: Both

Selections: Both
1 Hr
Graph
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for neutral-to-ground impulses.



1-Hr strip chart: neutral-to-ground impulse.



Graph: neutral-to-ground impulse.

If you choose:

Both - your PowerScope will print both strip charts and graphs.

1-Hr - (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance graphs.

Graph - your PowerScope will print disturbance graphs of this signal, but won't print strip charts.

Off - no disturbance graphs or strip charts will be printed for this signal; however the maximum reading of this signal will be reported textually in the summary reports.

If you are using probes, there will be more questions. See Chapter 6 (page 236) for an explanation of Report Menu questions for probes.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this signal.

The choices are: (1) BOTH, (2) a strip chart summary of the interval you selected in the 'Strip charts:' question above,(3) GRAPH, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a disturbance graph of this signal.

If you select the strip chart interval, you will get only a strip chart summary of this signal, without disturbance graphs.

If you choose GRAPH, your PowerScope will graph all disturbances for this signal but will not print a strip chart for this signal.

If you choose OFF, your PowerScope will print neither disturbance graphs nor a strip chart, but the minimum and maximum readings of this signal will still be printed in the summary reports.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of a strip chart summary in this question.

(Press HELP! again for general information on the Report Menu.)

WARNING
You are working with high voltages that cause burns and lethal shocks. Connect the safety earth ground first. USE STANDARD SAFETY PRECAUTIONS.

To connect to DC power, observe the polarity of the DC signal being monitored and connect the more positive to the red terminal on the back of the PowerScope, and the less positive signal to the black terminal.

To connect to AC power using independent channels, refer to the connection instructions for the particular power type you want to monitor.

For Single-Phase power, see page 44.
For Dual One-Phase power, see page 94.
For Three-Phase Delta power, see page 132.
For Three-Phase Wye power, see page 178.

Press the STATUS key to get a printout verifying that you've connected correctly, and that your initial readings are within the thresholds you've set.

```
INTRATECH LAB  6           Dec 07 1986

STATUS REPORT                  4:06 PM

AC INPUT (Channel 1)
   Voltage:      115.9 - 117.3 Vrms
   Frequency:     60.0 -  60.0 Hz
   Hi freq noise:  0.1 -   0.9 Vpk

5V SUPPLY (Channel 2)
   Voltage:        5.0 -   5.0 Vdc
   Hi freq noise:  0.7 -   1.3 Vpk

NEUT-GND (Channel 3)
   Voltage:        0.0 -   0.0 Vrms
   Hi freq noise:  1.2 -   1.6 Vpk

BATTERY CONDITION
   Voltage:    11.3 Vdc
   State:       Charged
```

Press the MONITOR key to begin monitoring.

Part 1: Setup Menu

This chapter shows you how to set up your PowerScope for using probes that monitor temperature, humidity, AC and DC power, and other parameters.

Part 1- explains the Setup Menu (where you set thresholds that define a disturbance),

and

Part 2- explains the Report Menu (where you turn graphs and reports on or off).

All probes plug into the sockets labeled A through H on the back of your Power Scope.

Plug your probes in before you answer questions in the Setup and Report Menus. It will take about 5 seconds for the PowerScope to recognize a probe. The questions that follow will appear after you've answered questions for setting power thresholds.

Temperature

The temperature probe monitors temperature and also the rate-of-temperature change.

Sensor Setup: A

Selections: A-H

Use the VALUE UP/ VALUE DOWN keys to select which environmental probe you will be setting thresholds for now.

For the sake of example, let's say you have a temperature probe plugged into environmental channel A and will set thresholds for it now.

BMI Model #A-002 Temperature Probe.

HELP!

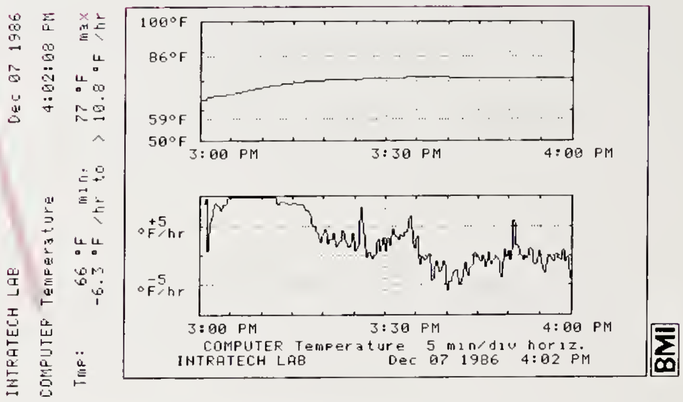
```
Use the VALUE UP/VALUE DOWN keys to
choose which probe you will set
thresholds for now.  The choices you
have will depend on which environ-
mental channels you have probes
plugged into. The eight environmental
channels are lettered A-H.

(Press HELP! again for general infor-
mation on the Setup Menu).
```

Temperature Name

Name: COMPUTER

Use the letter/number keypad to enter up to 9 characters to name this probe.

For example, to enter a C, press the 1ABC key four times. On the first press a 1 will appear, on the second press an A, on the third a B, and on the fourth press a C will appear.



Temperature and rate-of-temperature change 1-Hr strip chart.

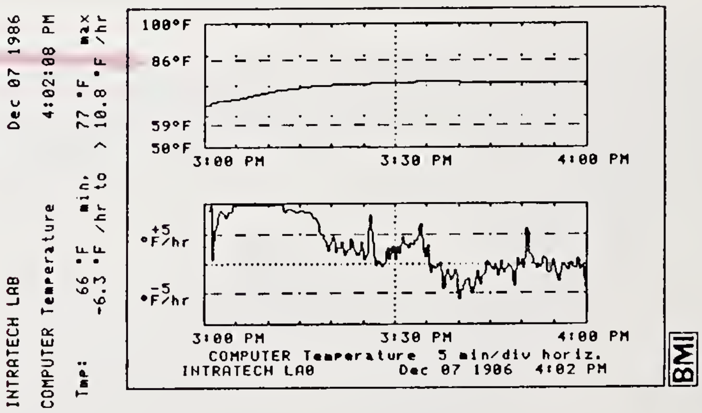
Press the right arrow key to move the flashing cursor to the next position. Press the 0 SPACE key twice for a space.

Temperature high threshold

COMPUTER high 86°F

Selections: 32° F to 212°F
(1°C to 100°C)

Use the number keys to enter in a high-temperature threshold for this probe.



The range is 32˚F to 212˚F (1˚ C to 100˚C). A typical value is 86˚F (30˚C).

NOTE: Use the Key Operator Menu to choose Celsius or Fahrenheit. See page 308.

HELP!

Enter up to 9 characters from the keyboard to name this temperature probe. You should name the probe for its location: For Example, Duct 3A.

Use the left and right arrow keys to move the flashing cursor. Use the number keys to enter both letters and numbers. For example, to enter the letter 'B', push the '2ABC' key three times. Then move the flashing cursor to the next character.

(There is no more HELP!)

Use the number keys to enter the high temperature threshold for this probe. The acceptable range is 1°C to 100°C (32°F to 212°F). A typical value is 30°C (86°F).

Press HELP! again for information on changing the temperature scale (C or F).

To change from degrees Celcius to degrees Fahrenheit or vice versa, use the Key Operator Menu (press the SETUP MENU key followed immediately by the UP ARROW key and answer the appropriate question).

(Press HELP! again for general information on the Setup menu).

Setup Menu, continued

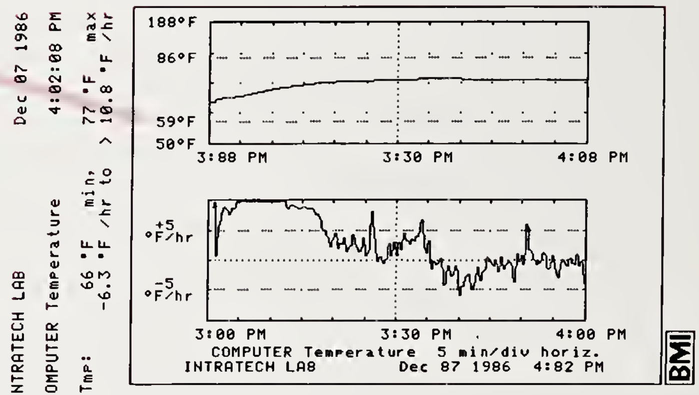
Temperature low threshold

COMPUTER LOW: 59°F

Selections: 32° F to 210°F
(0°C to 99°C)

Use the number keys to enter in a low-temperature threshold for this probe.

The range is 32˚F to 210˚F (0˚C to 99˚C). A typical value is 59˚F (15˚C).



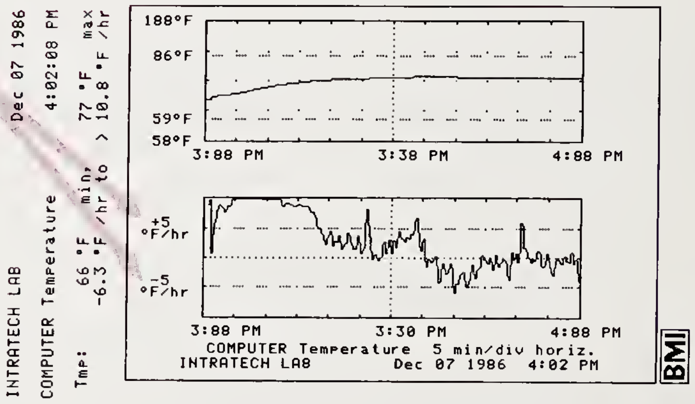
Temperature and rate-of-temperature change 1-Hr strip chart.

Temperature rate-of-change threshold

COMPUTER 5°F/hr

Selections: 2° F/hr to 178°F/hr
(1°C/hr to 99°C/hr)

Use the number keys to enter a rate-of-temperature change threshold for this probe.



The rate-of-temperature-change is in degrees per hour. The acceptable range is 2˚F/hr to 178˚F/hr (1˚C/hr to 99˚C/hr). A typical value is 5˚F/hr (3˚C/hr).

HELP!

Use the number keys to enter the low temperature threshold for this sensor. The acceptable range is 0}C to 99}C (32}F to 210}F). A typical value is 15}C (59}F).

(Press HELP! again for information on changing the temperature scale (C or F).

Use the number keys to enter the rate of temperature change threshold for this sensor in degrees per hour. The acceptable range is 1}C to 99}C (2}F to 178}F). A typical value is 3}C/hr (5}F/hr).

Press HELP! for information on how to change the temperature scale (C or F).

To change from degrees Celcius to degrees Fahrenheit or vice versa, use the Key Operator Menu (press the SETUP MENU key followed immediately by the UP ARROW key and answer the appropriate question).

(Press HELP! again for general information on the Setup menu).

To change from degrees Celcius to degrees Fahrenheit or vice versa, use the Key Operator Menu (press the SETUP MENU key followed immediately by the UP ARROW key and answer the appropriate question).

(Press HELP! again for general information on the Setup menu).

The temperature/humidity probe measures temperature, rate-of temperature change, humidity, and rate-of-humidity change.

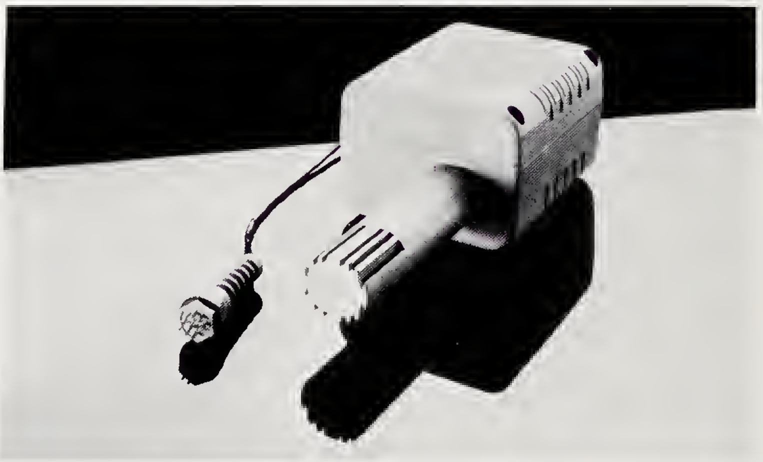
Temperature/ Humidity

Sensor Setup: B

Selections: A-H

Use the VALUE UP/ VALUE DOWN keys to select which enviromental probe you will be setting thresholds for now.

For the sake of example, let's say you have a temperature/humidity probe plugged into environmental Channel B and will set thresholds for it now.



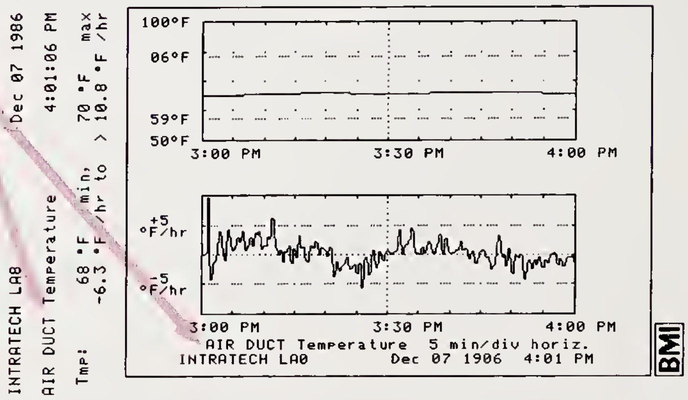
BMI Model #A-003 Temperature/Humidity probe.

Temperature/ Humidity name

Name: AIR DUCT

Use the number/letter keypad to enter up to 9 characters to name this probe.

For example, to enter an A, press the 1ABC key two times. On the first press a 1 will appear, and on the second press an A will appear.



Temperature and rate-of-temperature change 1-Hr strip chart.

Press the right arrow key to move the flashing cursor to the next position. Press the 0 SPACE key twice for a space.

HELP!

Use the VALUE UP/VALUE DOWN keys to choose which probe you will set thresholds for now. The choices you have will depend on which environmental channels you have probes plugged into. The eight environmental channels are lettered A-H.

(Press HELP! again for general information on the Setup Menu).

You may enter up to 9 characters from the keyboard to name this temperature/humidity probe. You should name the probe for its location: For Example, Duct 3A.

Use the left and right arrow keys to move the flashing cursor. Use the number keys to enter both letters and numbers. For example, to enter the letter 'B', push the '2ABC' key three times. Then move the flashing cursor to the next character.

(Press HELP! again for general information on the Setup Menu.)

Setup Menu, continued

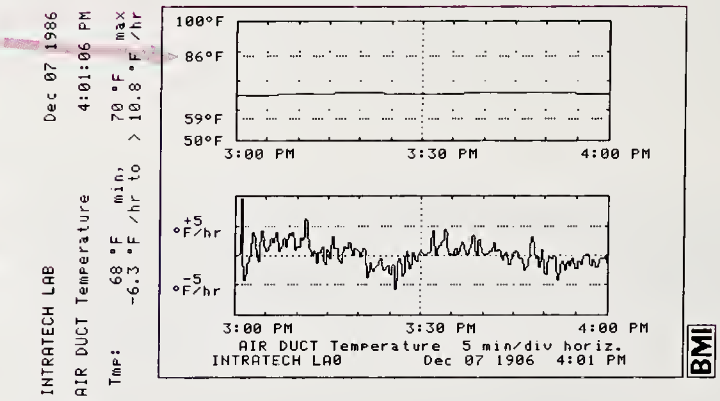
Temperature/Humidity high-temperature threshold

AIR DUCT high: 86°F

Selections: 32° F to 212° F
(1° C to 100° C)

Use the number keys to enter the high-temperature threshold for this probe.

The acceptable range is 32˚F to 212˚F (1˚C to 100˚C). A typical setting is 86˚F (30˚C).



Temperature and rate-of-temperature change 1-Hr strip chart.

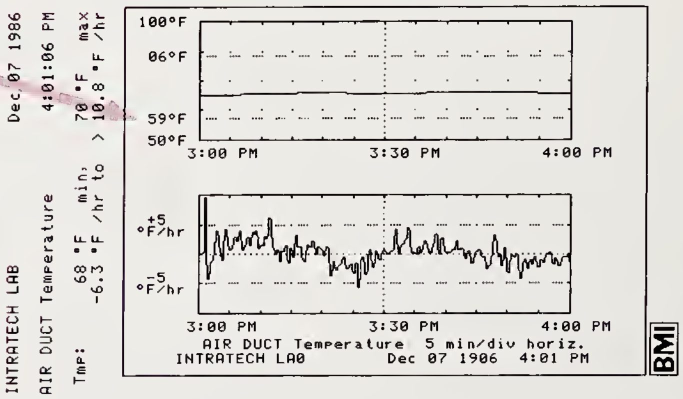
Temperature/Humditiy low-temperature threshold

AIR DUCT low: 59°F

Selections: 32° F to 210°F
(1°C to 99°C)

Use the number keys to enter in the low-temperature threshold for this probe.

The acceptable range is 32˚F to 210˚F (0˚C to 99˚C). A typical value is 59˚F (15˚C).



NOTE: Use the Key Operator Menu to choose Celsius or Fahrenheit. See page 308.

HELP!

```
Use the number keys to enter the high
temperature threshold for this probe.
The acceptable range is 1)C to 100)C
(32)F to 212)F).  A typical value is
30)C (86)F).

Press HELP! again for information on
changing the temperature scale (C or
F).
```

```
To change from degrees Celcius to
degrees Fahrenheit or vice versa, use
the Key Operator Menu (press the SETUP
MENU key followed immediately by the
UP ARROW key and answer the appro-
priate question).

(Press HELP! again for general infor-
mation on the Setup menu).
```

```
Use the number keys to enter the low
temperature threshold for this sensor.
The acceptable range is 0)C to 99)C
(32)F to 210)F).   A typical value is
15)C (59)F).

(Press HELP! again for information on
changing the temperature scale (C or
F).
```

```
To change from degrees Celcius to
degrees Fahrenheit or vice versa, use
the Key Operator Menu (press the SETUP
MENU key followed immediately by the
UP ARROW key and answer the appro-
priate question).

(Press HELP! again for general infor-
mation on the Setup menu).
```

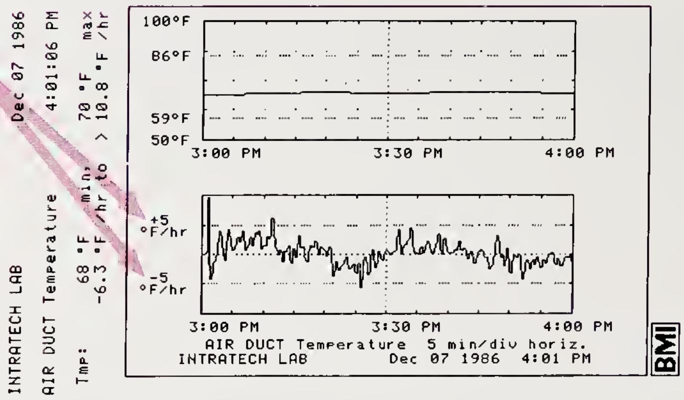
Setup Menu, continued

Temperature/ Humidity rate-of-temperature change threshold

AIR DUCT 5°F/hr

Selections: 2°F/hr to 178°F/hr
(1°C/hr to 99°C/hr)

Use the number keys to enter in the rate-of-temperature change threshold for this probe.



Temperature and rate-of-temperature change 1-Hr strip chart.

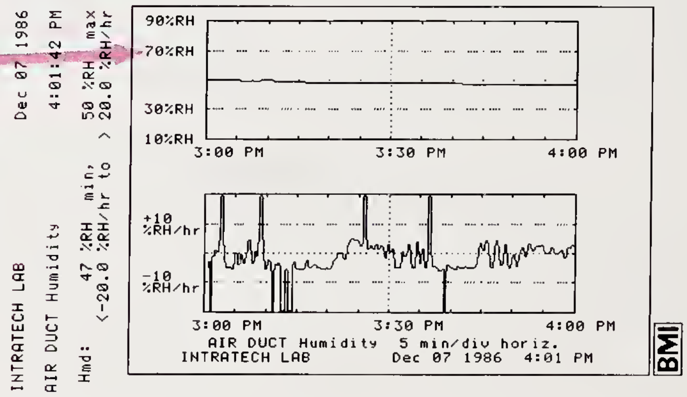
The rate-of-temperature change is in degrees per hour. The acceptable range is 2°F/hr to 178°F/hr (1°C/hr to 99°C/hr). A typical value is 5°F/hr (3°C/hr).

Temperature/ Humidity high humidity threshold

AIR DUCT high: 70%RH

Selections: 1% to 99%
Relative Humidity

Use the number keys to enter in the high-humidity threshold for this probe.



Humidity and rate-of-humidity change 1-Hr strip chart.

The acceptable range is 1% to 99% Relative Humidity. A typical value is 60% Relative Humidity.

HELP!

Use the number keys to enter the rate of temperature change threshold for this sensor in degrees per hour. The acceptable range is 1°C to 99°C (2°F to 178°F). A typical value is 3°C/hr (5°F/hr).

Press HELP! for information on how to change the temperature scale (C or F).

Use the number keys to enter the high humidity threshold for this sensor. The acceptable range is 1% to 99% Relative Humidity. A typical value is 60% Relative Humidity.

(Press HELP! again for general information on the Setup Menu.)

To change from degrees Celcius to degrees Fahrenheit or vice versa, use the Key Operator Menu (press the SETUP MENU key followed immediately by the UP ARROW key and answer the appropriate question).

(Press HELP! again for general information on the Setup menu).

Setup menu, continued

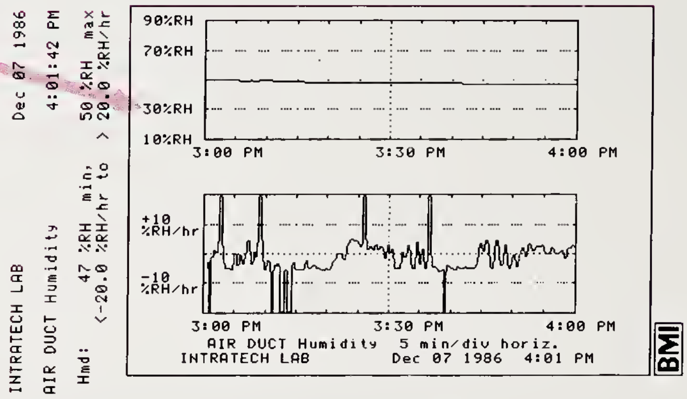
Temperature/Humidity low humidity threshold

AIR DUCT low: 30%RH

Selections: 1% to 99%
Relative Humidity

Use the number keys to enter the low-humidity threshold for this probe.

The range is 0% to 98% Relative Humidity.
A typical value is 40% RH.



Humidity and rate-of-humidity change 1-Hr strip chart.

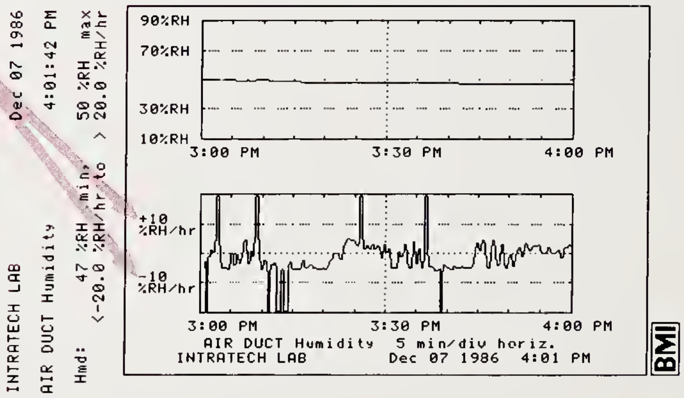
Temperature/Humidity rate-of-humidity change threshold

AIR DUCT: 10% RH/hr

Selections: 0% RH/hr to
99% RH/hr

Use the number keys to enter the threshold for the percent-of-change in relative humidity.

The range is 0%/hr to 99%/hr. A typical value is 5% change per hour.



HELP!

Use the number keys to enter the low humidity threshold for this sensor. The acceptable range is 0% to 98% Relative Humidity. A typical value is 40% Relative Humidity.

(Press HELP! again for general information on the Setup Menu).

Use the number keys to enter the maximum acceptable rate of change in humidity for this sensor in percent RH per hour. The acceptable range is 1% to 99% relative humidity. A typical value is 5% RH per hour.

(Press HELP! again for general information on the Setup Menu).

Setup Menu, continued

The radio frequency interference probe measures radio frequency interference and radio frequency surges.

Radio Frequency Interference

Sensor Setup: C

Selections: A to H

Use the VALUE UP/ VALUE DOWN keys to select which probe you will set thresholds for now.

For the sake of example, let's say you have a radio frequency probe plugged into Channel C and will set its thresholds now.

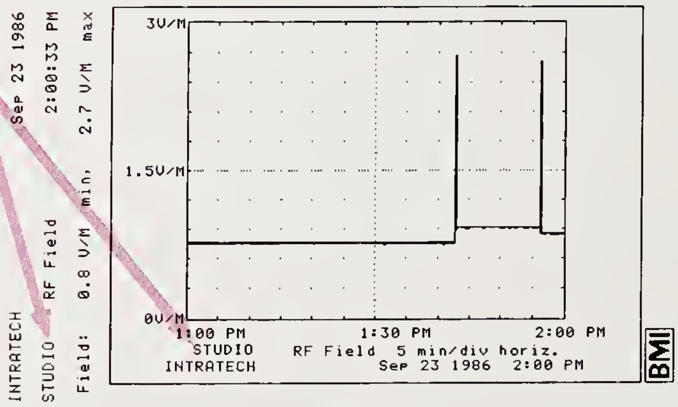
BMI Model #A-008 Cable Set and Supporting Software for Instruments for Industry Radio Frequency Probe Model EFS-3.

Radio Frequency Interference name

Name: STUDIO

Use the number/letter keypad to enter up to 9 characters to name this probe.

For example, to enter an S, press the 8STU key twice. On the first press an 8 will appear, and on the second press an S will appear. Use the right arrow key to advance the cursor. Press the 0 SPACE key twice to enter a space.



Radio-frequency interference 1-Hr strip chart.

HELP!

Use the VALUE UP/VALUE DOWN keys to choose which probe you will set thresholds for now. The choices you have will depend on which environmental channels you have probes plugged into. The eight environmental channels are lettered A-H.

(Press HELP! again for general information on the Setup Menu).

You may enter up to 9 characters from the keyboard to name the radio frequency probe plugged into this channel.

Use the left and right arrow keys to move the flashing cursor.

Use the number keys to enter both letters and numbers. For example, to enter the letter 'B', push the '2ABC' key three times. Then move the flashing cursor to the next character.

(Press HELP! again for general information on the Setup Menu).

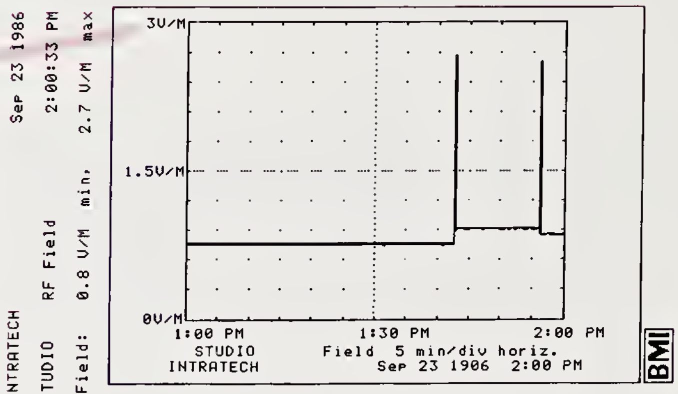
Setup Menu, continued

Radio Frequency Interference full-scale range

STUDIO range: 3V/M

Selections: 3V/M
10V/M
30V/M
100V/M
300V/M

Use the VALUE UP/VALUE DOWN keys to select the full-scale range for this radio frequency probe.



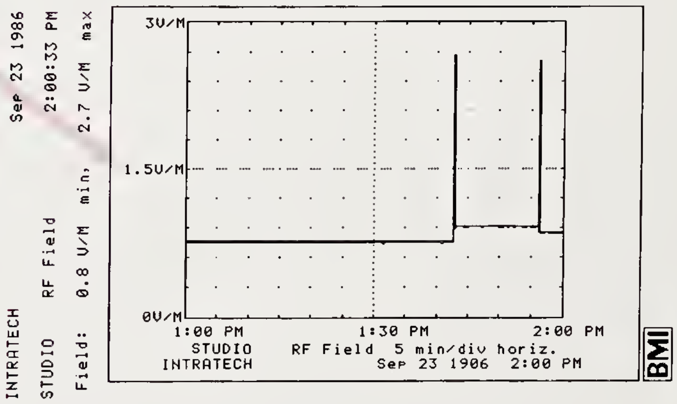
Radio-frequency interference 1-Hr strip chart.

The range is in volts per meter. Make sure the sensor is set to the same surge. See the sensor manual.

Radio Frequency Interference surge threshold

STUDIO surge: 1.5V/M

Use the number keys to select a radio field strength surge threshold for this probe.

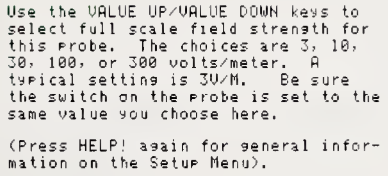


Your choices are affected by the full-scale range you chose in the last question as follows:

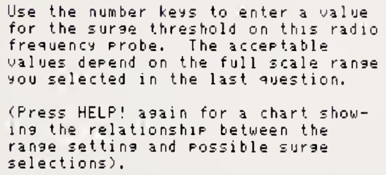
RFI Surge Threshold Table

Full Scale	Default Setting	Acceptable Range
3 V/M	1.5 V/M	0.1 - 3.0 V/M
10 V/M	5.0 V/M	1.0 - 10.0 V/M
30 V/M	15.0 V/M	1.0 - 30.0 V/M
100 V/M	50.0 V/M	1.0 - 100.0 V/M
300 V/M	150.0 V/M	1.0 - 300.0 V/M

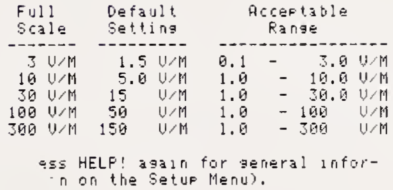
HELP!



```
Use the VALUE UP/VALUE DOWN keys to
select full scale field strength for
this probe.  The choices are 3, 10,
30, 100, or 300 volts/meter.  A
typical setting is 3V/M.   Be sure
the switch on the probe is set to the
same value you choose here.

(Press HELP! again for general infor-
mation on the Setup Menu).
```



```
Use the number keys to enter a value
for the surge threshold on this radio
frequency probe.  The acceptable
values depend on the full scale range
you selected in the last question.

(Press HELP! again for a chart show-
ing the relationship between the
range setting and possible surge
selections).
```



```
 Full     Default       Acceptable
 Scale    Setting         Range
-------  ---------   -----------------
  3 V/M     1.5 V/M   0.1  -    3.0 V/M
 10 V/M     5.0 V/M   1.0   -  10.0 V/M
 30 V/M   15    V/M   1.0   -  30.0 V/M
100 V/M   50    V/M   1.0   - 100    V/M
300 V/M  150    V/M   1.0   - 300    V/M

    ess HELP! again for general infor-
     n on the Setup Menu).
```

Setup Menu, continued

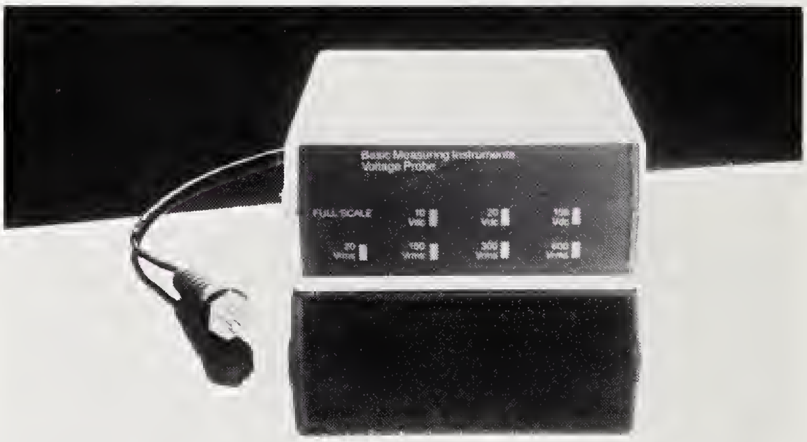
AC/DC Impulse

The AC/DC/Impulse probe measures either AC lines where it makes true RMS measurements, or DC voltage where it monitors batteries and DC supplies.

Sensor setup: D

Use the VALUE UP/ VALUE DOWN keys to select which probe you will be setting thresholds for now.

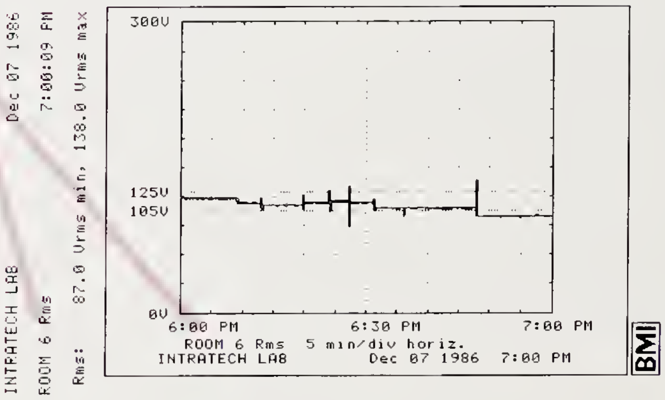
For the sake of example, let's say you have an AC/DC/Impulse probe plugged into Channel D.



BMI Model #A-111 AC/DC/Impulse probe.

AC/DC Impulse Probes name

Name: ROOM 6



Enter up to 9 characters from the keypad to name this probe.

For example, to enter an R, press the 7PQR key four times. On the first press, a 7 will appear, on the second press a P will appear, on the third press a Q, and on the fourth press an R will appear. Press the right arrow key to advance the cursor. Press the 0 SPACE key twice to enter a space.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
choose which probe you will set
thresholds for now.  The choices you
have will depend on which environ-
mental channels you have probes
plugged into. The eight environmental
channels are lettered A-H.

(Press HELP! again for general infor-
mation on the Setup Menu).
```

```
You may enter up to 9 characters from
the keyboard to name this AC/DC
Voltage/Impulse probe.

Use the left and right arrow keys to
move the flashing cursor.   Use the
number keys to enter both letters and
numbers.   For example, to enter the
letter 'B', push the '2ABC' key three
times.  Then move the flashing cursor
to the next character.

(There is no more HELP!)
```

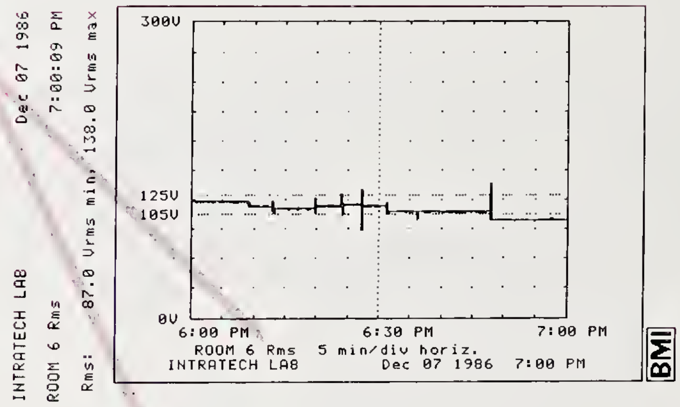
Setup Menu, continued

AC/DC Impulse mode

Sensor Mode: Rms

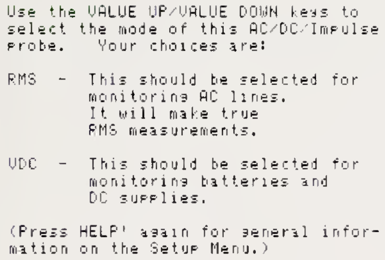
Selections: Rms
Vdc

Use the VALUE UP/ VALUE DOWN keys to choose whether you will use this probe to monitor alternating or direct current.



```
INTRATECH LAB                      Dec 07 1986

ROOM 6     VOLTAGE SAG              4:45:50 PM
(Sensor B)

 Voltage below            105.0 Vrms



--------------------------------------------
INTRATECH LAB                      Dec 07 1986

ROOM 6     VOLTAGE SAG END          4:45:58 PM
(Sensor B)

 Minimum voltage:          72.0 Vrms
```

HELP!



```
Use the VALUE UP/VALUE DOWN keys to
select the mode of this AC/DC/Impulse
probe.   Your choices are:

RMS  -  This should be selected for
        monitoring AC lines.
        It will make true
        RMS measurements.

VDC  -  This should be selected for
        monitoring batteries and
        DC supplies.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Setup Menu, continued

AC/DC Impulse high-voltage threshold

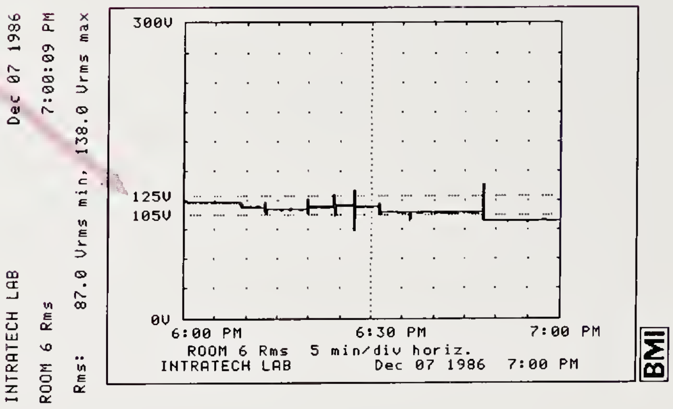
Room 6 high: 125.0 Vrms

Selections:	1.0 to 600.0 Vrms 1.0 to 99.9 Vdc

Use the number keys to enter the high-voltage threshold for this probe.

The acceptable range is 1.0 to 600.0 Vrms, or 1.0 to 99.9 Vdc. Usually the threshold should be set to 10% above the nominal voltage. A typical value is 125.0 Vrms, or 5.5 Vdc.

The full-scale range is determine by the high-voltage threshold as follows:



Rms 1-Hr strip chart.

```
INTRATECH LAB                    Dec 07 1986

ROOM 6     VOLTAGE SURGE        4:44:44 PM
(Sensor B)

 Voltage above          125.0 Vrms



------------------------------------------
INTRATECH LAB                    Dec 07 1986

ROOM 6     VOLT SURGE END       4:44:50 PM
(Sensor B)

 Maximum voltage:       132.0 Vrms
```

Rms disturbance text report.

Rms Full-scale Range Table

High-voltage threshold	Full-scale range
1.0 - 15.0 Vrms	20.0 Vrms
15.1 - 75.0 Vrms	150.0 Vrms
75.1 - 150.0 Vrms	300.0 Vrms
150.1 - 600.0 Vrms	600.0 Vrms

Vdc Full-scale Range Table

High-voltage threshold	Full-scale range
1.0 - 6.0 Vdc	10.0 Vdc
6.1 - 16.0 Vdc	20.0 Vdc
16.1 - 99.9 Vdc	100.0 Vdc

HELP!

```
Use the number keys to enter the high
voltage threshold for this probe.  The
usual value is about 10% above the
nominal voltage.  The acceptable range
is 1.0 Vrms to 600.0 Vrms.   A typical
value is 125.0 Vrms.

(Press HELP! again for information on
how threshold settings affect the
full scale range of this probe.)
```

```
Use the number keys to enter the high
voltage threshold for this sensor.
The usual value is about 10% above the
nominal voltage.  The acceptable range
is 1.0 Vdc to 99.9 Vdc.  A typical
value is 5.5 Vdc.

(Press HELP! again for information on
how threshold settings affect the
full scale range of this probe).
```

```
The high voltage threshold that
you select will also determine the
full scale setting of this probe, as
follows:

   High Voltage          Full Scale
    threshold             setting
------------------       ----------

  1.0 -  15.0 Vrms        20.0 Vrms
 15.1 -  75.0 Vrms       150.0 Vrms
 75.1 - 150.0 Vrms       300.0 Vrms
150.1 - 600.0 Vrms       600.0 Vrms

(Press HELP! again for general infor-
 ation on the Setup menu.)
```

```
The threshold that you select
will also determine the full scale
reading of the probe, as follows:

   High Voltage           Full scale
    threshold              setting
------------------        ----------

 1.0 Vdc -  6.0 Vdc         10.0 Vdc
 6.1 Vdc - 16.0 Vdc         20.0 Vdc
16.1 Vdc - 99.9 Vdc        100.0 Vdc

(Press HELP! again for general infor-
mation on the Setup menu).
```

Setup Menu, continued

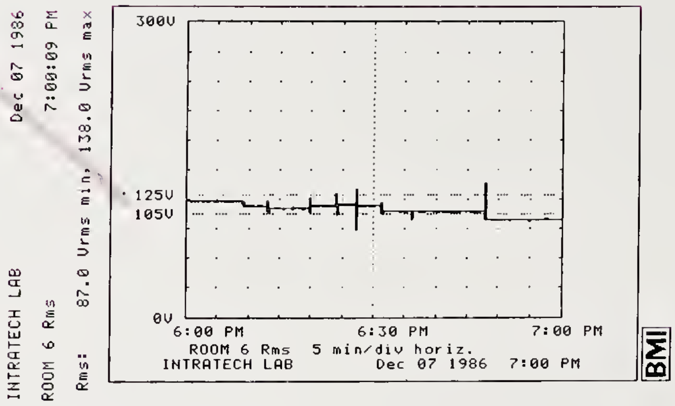
AC/DC Impulse low-voltage threshold

Room 6 low: 105.0 Vrms

Selections: 0.0 to 599.9 Vrms
0.0 to 99.8 Vdc

Use the number keys to enter the low-voltage threshold for this probe.

The acceptable range is 0.0 to 599.9 Vrms, or 0.0 to 99.8 Vdc. Usually the setting should be made to 15% below the nominal voltage. A typical value is 105.0 Vrms, or 4.5 Vdc.



Rms 1-Hr strip chart.

```
INTRATECH LAB                    Dec 07 1986
ROOM 6     VOLTAGE SAG            4:45:50 PM
(Sensor B)

 Voltage below          105.0 Vrms


---------------------------------------------
INTRATECH LAB                    Dec 07 1986
ROOM 6     VOLTAGE SAG END        4:45:58 PM
(Sensor B)

 Minimum voltage:        72.0 Vrms
```

Rms disturbance text report.

HELP!

```
Use the number keys to enter the low
voltage threshold for this sensor. The
usual value is about 10% below the
nominal voltage.  The acceptable range
is 0.0 Vrms to 599.9 Vrms.   A typical
value is 105.0 Vrms.

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

```
Use the number keys to enter the low
voltage threshold for this probe.  The
usual value is about 10% below the
nominal voltage.  The acceptable range
is 0.0 Vdc to 99.9 Vdc.  A typical
value is 4.5 Vdc.

(Press HELP! again for general infor-
mation on the Setup Menu).
```

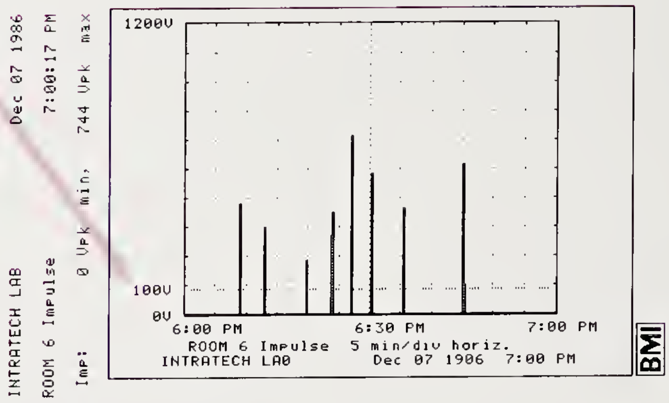
Setup Menu

AC/DC Impulse impulse threshold

Room 6 Impulse: 100 Vpk

Use the number keys to enter the impulse threshold.

The acceptable impulse threshold settings for this probe depend on the high-voltage threshold you set in the previous question as follows:



Impulse 1-Hr strip chart.

```
INTRATECH LAB                  Dec 07 1986

ROOM 6    IMPULSE               4:45:29 PM
(Sensor B)

 Peak voltage:               780 Vpk
```

Impulse text report.

AC Impulse Ranging Table

High Voltage Threshold AC	Full Scale Setting AC	Acceptable Impulse Threshold AC
1.0 - 15.0 Vrms	20.0 Vrms	10.0 - 80.0 Vpk
15.1 - 75.0 Vrms	150.0 Vrms	10.0 - 600 Vpk
75.1 - 150.0 Vrms	300.0 Vrms	20.0 - 1200 Vpk
150.1 - 600.0 Vrms	600.0 Vrms	40.0 - 2400 Vpk

DC Impulse Ranging Table

High Voltage Threshold DC	Full Scale Setting DC	Acceptable Impulse Threshold DC
1.0 - 6.0 Vdc	10.0 Vdc	10 - 40 Vpk
6.1 - 16.0 Vdc	20.0 Vdc	10 - 80 Vpk
16.1 - 99.9 Vdc	100.0 Vdc	10 - 400 Vpk

HELP!

```
Use the number keys to enter the
impulse threshold for this sensor. The
acceptable range of impulse thresholds
depends on the high voltage threshold
that you have selected for this probe.

(Press HELP! again for information on
how high voltage thresholds affect
impulse thresholds if monitoring DC.
Press HELP! twice for information
on how high voltage thresholds affect
impulse thresholds if monitoring AC).
```

```
This chart applies if you are
monitoring DC:

 High Voltage        Acceptable impulse
  threshold              thresholds
---------------     ------------------

 1.0 -  6.0 Vdc       10 Vpk -  40 Vpk
 6.1 - 15.0 Vdc       10 Vpk -  80 Vpk
15.1 - 99.9 Vdc       10 Vpk - 400 Vpk
```

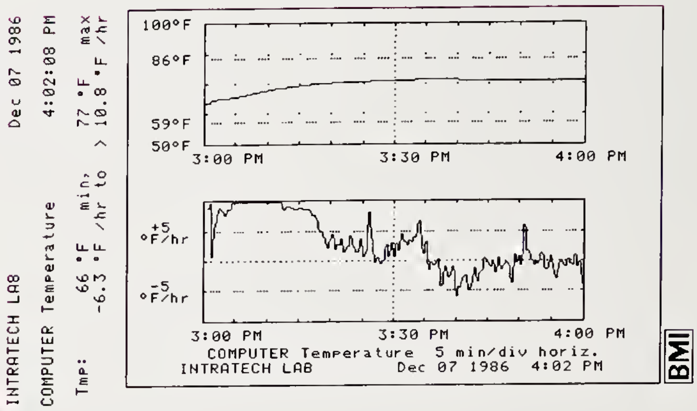
```
If you are monitoring AC, this
chart applies:

   High Voltage       Acceptable impulse
    threshold             threshold
------------------  ------------------

  1.0 -  15.0 Vrms  10 Vpk -   80 Vpk
 15.1 -  75.0 Vrms  10 Vpk -  600 Vpk
 75.1 - 150.0 Vrms  20 Vpk - 1200 Vpk
150.1 - 600.0 Vrms  40 Vpk - 2400 Vpk

(Press HELP! again for general infor-
mation on the Setup Menu.)
```

Temperature

COMPUTER TMP: Both

Selections: Both
1 Hr
Text
Off

Use the VALUE UP/ VALUE DOWN keys to select reporting for temperature.



1-Hr strip chart: Temperature and rate-of-temperature change.

```
INTRATECH                      Jan 12 1987

COMPUTER  HIGH TEMPERATURE 12:21:14 PM
(Sensor A)

 Temperature above        86 °F

 ---------------------------------------------
INTRATECH                      Jan 13 1987

COMPUTER  HIGH TEMP END      10:57:55 AM
(Sensor A)

 Maximum temperature:      88 °F
```

Text report: Temperature.

If you choose:

Both - your PowerScope will print both strip charts and text reports.

1-Hr - (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance text reports.

Text - your PowerScope will print disturbance text reports of this signal, but won't print strip charts.

Off - no disturbance text reports or strip charts will be printed for this signal; however the minimum and maximum readings will still be reported textually in the strip chart reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you would like
for this probe.

The choices are: (1) BOTH, (2) A
strip chart summary of the interval
you selected in the 'Strip charts:'
question above, (3) TEXT, and (4) OFF.

If you select BOTH, your PowerScope
will print both strip chart summaries
and textual disturbance reports of
this signal.

If you select the strip chart
interval, you will get only strip
chart summaries of this signal.

If you choose TEXT, your PowerScope
will print textual disturbance reports
of all disturbances for this signal
but will not print strip charts for
this signal.

If you choose OFF, your PowerScope
will print neither textual reports
nor strip charts, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu,
you will not have the choice of
strip chart summaries in this
question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

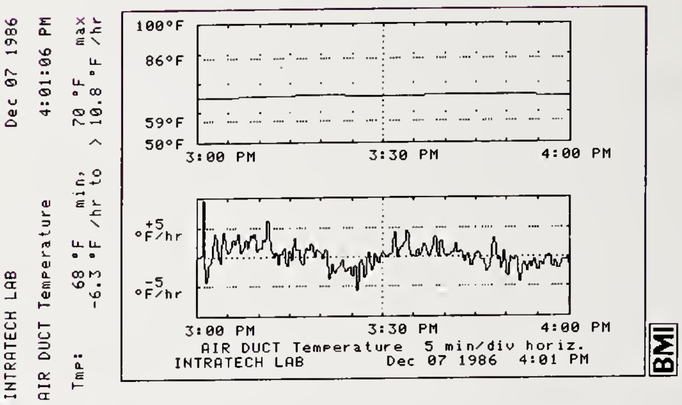
Report Menu, continued

Temperature/ Humidity

AIR DUCT TMP: Both

Selections: Both
1 Hr
Text
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the temperature measurement from the temperature/ humidity probe.



1-Hr strip chart: Temperature and rate-of-temperature change.

```
INTRATECH                          Jan 12 1987
AIR DUCT  HIGH TEMPERATURE 11:36:25 AM
(Sensor A)
 Temperature above          86 °F

---------------------------------------------
INTRATECH                          Jan 12 1987
AIR DUCT  HIGH TEMP END        11:40:48 AM
(Sensor A)
 Maximum temperature:        99 °F
```

Text report: Temperature.

If you choose:

Both - your PowerScope will print both strip charts and text reports.

1-Hr (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance text reports.

Text - your PowerScope will print disturbance text reports of this signal, but won't print strip charts.

Off - no disturbance text reports or strip charts will be printed for this signal; however the minimum and maximum readings will still be reported textually in the strip chart reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this signal.

The choices are: (1) BOTH, (2) a
strip chart summary of the interval
you selected in the 'Strip charts:'
question above, (3) TEXT, and (4)
OFF.

If you select BOTH, your PowerScope
will print both a strip chart
summary and a textual disturbance
reports of this signal.

If you select the strip chart
interval, you will get only a strip
chart summary of this signal, without
disturbance reports.

If you choose TEXT, your PowerScope
will print a textual report of all
disturbances for this signal but
will not print a strip chart for
this signal.

If you choose OFF, your PowerScope
will print neither textual reports
 nor a strip chart, but the minimum
and maximum readings of this signal
will still be printed in the summary
reports.

If you turned strip charts off at
the beginning of the Report Menu,
you will not have the choice of
strip chart summaries in this
question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

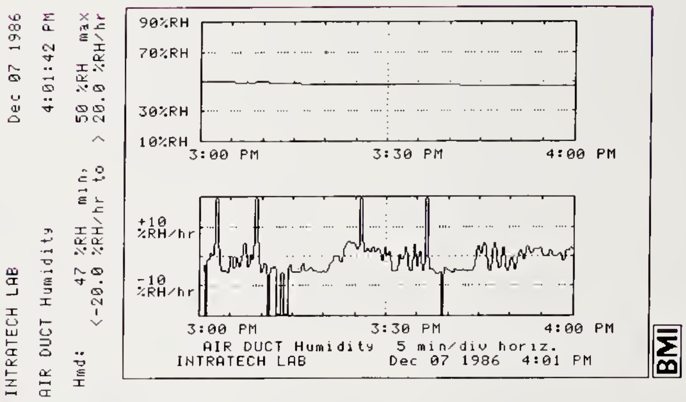
Report Menu, continued

Temperature/ Humidity

AIR DUCT Hmd: Both

Selections: Both
1 Hr
Text
Off

Use the VALUE UP/ VALUE DOWN keys to select reporting for the humidity measurement from the temperature/ humidity probe.



1-Hr strip chart: Humidity and rate-of-humidity change.

```
INTRATECH                    Jan 12 1987

AIR DUCT  HIGH HUMIDITY      12:19:22 PM
(Sensor A)

 Humidity above             70 %RH
---------------------------------------
INTRATECH                    Jan 13 1987

AIR DUCT  HIGH HMD END       10:57:25 AM
(Sensor A)

 Maximum humidity:          94 %RH
```

Text report: humidity.

If you choose:

Both - your PowerScope will print both strip charts and text reports.

1-Hr - (1, 3, 6, 12, or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance text reports.

Text - your PowerScope will print disturbance text reports of this signal, but won't print strip charts.

Off - no disturbance text reports or strip charts will be printed for this signal; however the minimum and maximum readings will still be reported textually in the strip chart reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this probe.

The choices are: (1) BOTH, (2) A
strip chart summary of a duration
you specified in the 'Strip charts:'
question above (3) TEXT, and (4)
OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a textual report of this signal.

If you select the strip chart, you
will get only a strip chart summary
of this signal.

If you choose TEXT, your PowerScope
will print a textual report of all
disturbances for this signal but
will not print a strip chart for this
signal.

If you turned strip charts off at the
beginning of the Report Menu, you will
not have the choice of strip chart
summaries in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

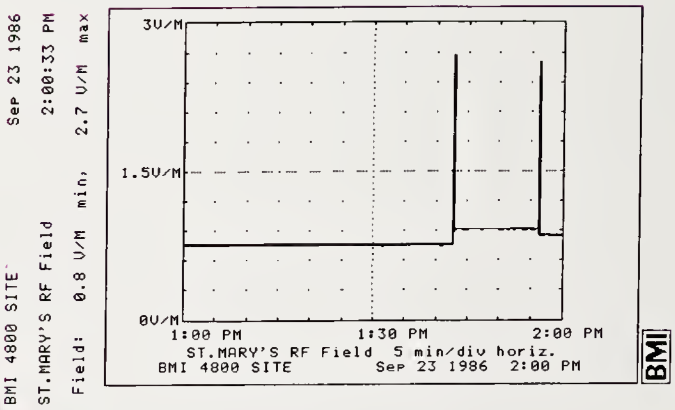
Report Menu, continued

Radio-Frequency Interference

STUDIO V/M: Both

Selections: Both
1 Hr
Text
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the radio frequency interference probe.



1-Hr strip chart: Radio-frequency interference.

```
INTRATECH                  Jan 12 1987

STUDIO     RF SURGE        12:30:32 PM
(Sensor A)

 Voltage above           1.5 V/M

--------------------------------------
INTRATECH                  Jan 13 1987

STUDIO     RF SURGE END    11:07:14 AM
(Sensor A)

 Maximum voltage:        2.3 V/M
```

Text report: Radio-frequency interference.

If you choose:

Both - your PowerScope will print both strip charts and text reports.

1-Hr (1, 3, 6, 12 or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance text reports.

Text - your PowerScope will print disturbance text reports of this signal, but won't print strip charts.

Off - no disturbance text reports or strip charts will be printed for this signal; however the minimum and maximum readings will still be reported textually in the strip chart reports.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the report(s) you'd like for
this probe.

The choices are: (1) BOTH, (2) A
strip chart summary of a duration
you specified in the 'Strip charts:'
question above (3) TEXT, and (4)
OFF.

If you select BOTH, your PowerScope
will print both a strip chart summary
and a textual report of this signal.

If you select the strip chart, you
will get only a strip chart summary
of this signal.

If you choose TEXT, your PowerScope
will print a textual report of all
disturbances for this signal but
will not print a strip chart for this
signal.

If you turned strip charts off at the
beginning of the Report Menu, you will
not have the choice of strip chart
summaries in this question.

(Press HELP! again for general infor-
mation on the Report Menu.)
```

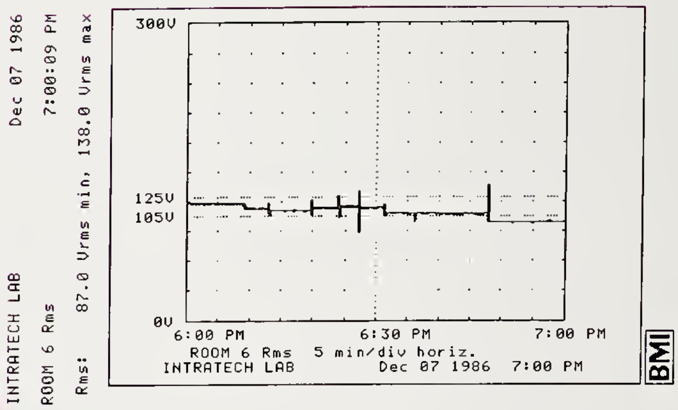
Report Menu, continued

AC/DC/ Impulse

ROOM 6 Rms: Both

Selections: Both
1 Hr
Text
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for the voltage signal of the AC/DC/ Impulse probe.



1-Hr strip chart: Rms.

```
INTRATECH LAB                  Dec 07 1986

ROOM 6     VOLTAGE SAG          4:45:50 PM
(Sensor B)

 Voltage below          105.0 Vrms



----------------------------------------
INTRATECH LAB                  Dec 07 1986

ROOM 6     VOLTAGE SAG END     4:45:58 PM
(Sensor B)

 Minimum voltage:        72.0 Vrms
```

Text report: Rms.

If you choose:

Both - your PowerScope will print both strip charts and text reports.

1-Hr - (1, 3, 6, 12 or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance text reports of this signal.

Text - your PowerScope will print disturbance text reports of this signal, but won't print strip charts.

Off - no disturbance text reports or strip charts will be printed for this signal; however the minimum and maximum readings will still be reported textually in the strip chart reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this probe.

The choices are: (1) BOTH, (2) A strip chart summary of a duration you specified in the 'Strip charts:' question above (3) TEXT, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a textual report of this signal.

If you select the strip chart, you will get only a strip chart summary of this signal.

If you choose TEXT, your PowerScope will print a textual report of all disturbances for this signal but will not print a strip chart for this signal.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of strip chart summaries in this question.

(Press HELP! again for general information on the Report Menu.)

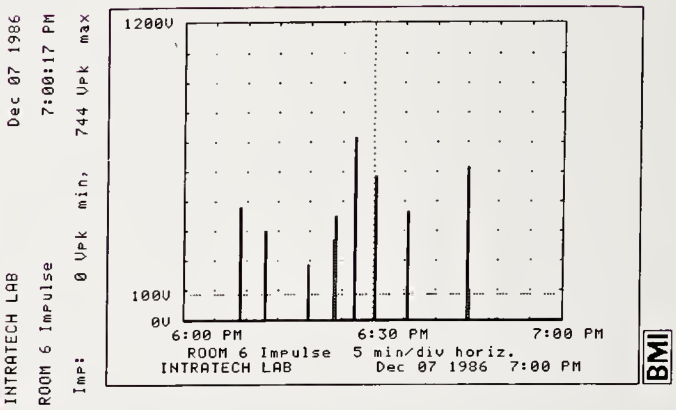
Report Menu, continued

AC/DC/Impulse

ROOM 6 Imp: Both

Selections: Both
1 Hr
Text
Off

Use the VALUE UP/ VALUE DOWN keys to select the reporting for this impulse probe.



1-Hr strip chart: impulse signal from AC/DC/Impulse probe.

```
INTRATECH LAB                  Dec 07 1986

ROOM 6    IMPULSE               4:45:29 PM
(Sensor B)

 Peak voltage:              780 Vpk
```

Text report: impulse.

If you choose:

Both - your PowerScope will print both strip charts and text reports.

1-Hr (1, 3, 6, 12 or 24 hours) - your PowerScope will print strip charts of this signal, but won't print disturbance text reports.

Text - your PowerScope will print distubance text reports of this signal, but won't print strip charts.

Off - no disturbance text reports or strip charts will be printed for this signal, however the maximum reading will still be reported textually in the strip chart reports.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the report(s) you'd like for this probe.

The choices are: (1) BOTH, (2) A strip chart summary of a duration you specified in the 'Strip charts:' question above (3) TEXT, and (4) OFF.

If you select BOTH, your PowerScope will print both a strip chart summary and a textual report of this signal.

If you select the strip chart, you will get only a strip chart summary of this signal.

If you choose TEXT, your PowerScope will print a textual report of all disturbances for this signal but will not print a strip chart for this signal.

If you turned strip charts off at the beginning of the Report Menu, you will not have the choice of strip chart summaries in this question.

(Press HELP! again for general information on the Report Menu.)

The Key Operator menu lets you control administrative detail, such as the calendar and clock, Centigrade or Fahrenheit temperature scale, etc.

Quick Guide

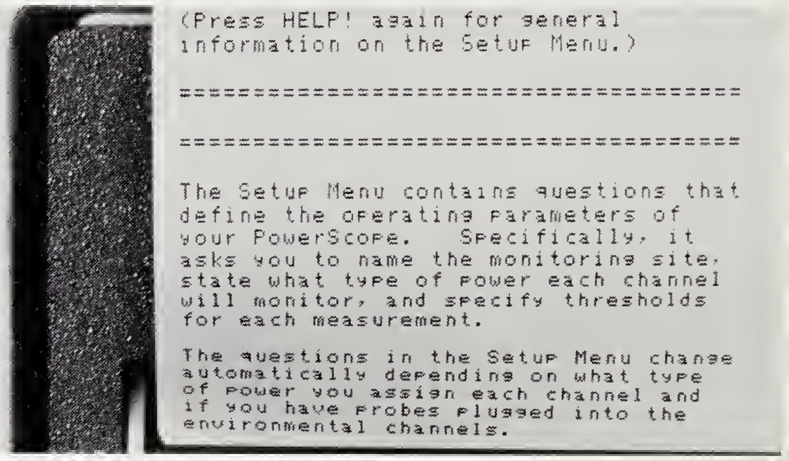
1. **Press the SETUP MENU key, then quickly press the up arrow.**
2. **Use the VALUE UP/VALUE DOWN keys or the number letter keypad to answer the questions in the menu.**
3. **Press the down arrow to go to the next question.**
4. **Press the HELP! key if you want further explanation about the questions.**

Help: English

Selections: English
French

Use the VALUE UP/ VALUE DOWN keys to select the language you prefer for the HELP messages.

(The menus and reports are always printed in English.)



```
(Press HELP! again for general
information on the Setup Menu.)

======================================

======================================

The Setup Menu contains questions that
define the operating parameters of
your PowerScope.   Specifically, it
asks you to name the monitoring site,
state what type of power each channel
will monitor, and specify thresholds
for each measurement.

The questions in the Setup Menu change
automatically depending on what type
of power you assign each channel and
if you have probes plugged into the
environmental channels.
```

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the language of your choice
for help messages, English or French.

(Press HELP! again for general infor-
mation on the Key Operator Menu).
```

```
The Key Operator Menu contains
questions that define some of the
detailed operation of your Power-
Scope.

These questions request information
on language, clock, internal ups,
keyboard click, temperature,
impedence, frequency, waveshape,
hysteresis, and impulse ranging.

The Key Operator Menu usually
does not change often.

(Press HELP! again for general
information on the operating
sequence.
```

```
The usual sequence for operating
the PowerScope monitor is:

  1) Press the SETUP MENU key and
     answer the questions.
     To go on to the next question,
     press the Down Arrow.

  2) Connect the monitor to the
     power line. (See the HELP!
     message in the Setup Menu
     for the 'TYPE:' question.)

  3) Press the MONITOR key to monitor
     the power line.  Your reports
     will be printed automatically.

(Press HELP! again for general infor-
mation on the six modes of operation.)
```

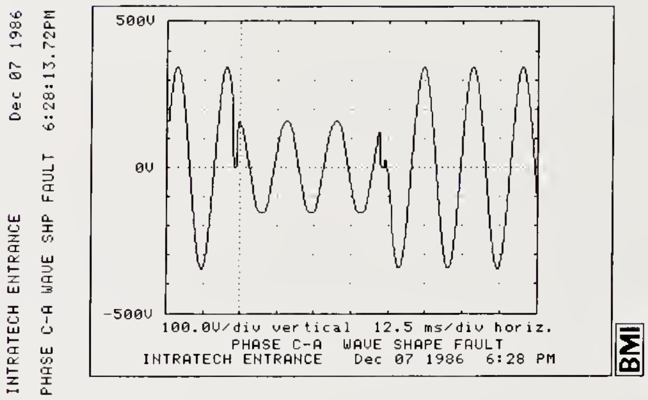
```
The PowerScope monitor can be in one
of six modes:

   1) Press the SETUP MENU key to
      program the Setup Menu.
      Use the up arrow and the down
      arrow key to work your way
      through the questions on the
      menu. The 'HELP!' key will
      always give you information
      on a question on the menu.
      (You may want to press 'HELP!'
      when you have selected the type
      of power line you are going to
      monitor. This will give you
      installation instructions.)

      By pressing the SETUP MENU key,
      then immediately pressing the
      UP ARROW key, you will enter
      the Key Operator Menu.  This
      menu will give you control of
      the detailed operation of the
      PowerScope.

   2) Press the STATUS key to print
      the Status Report.  This
      report tells you the present
      voltage, frequency, and noise
      on each of the channels.  This
      report can be especially
      useful when you're trying to
      set the thresholds correctly.
      It's also useful for checking
      to see if you've installed the
      monitor correctly.

   3) Press the REPORT MENU key to
      enter the Report menu.  Use
      the up arrow and the down
      arrow to work your way through
      the questions on the menu.
      The 'HELP!' key will always
      give you information on a
      question on the menu.

   4) Press the MONITOR key to start
      monitoring the power line.
      The PowerScope will print a
      complete copy of your setup,
      and show you the initial wave-
      shapes on each channel (if you
      have requested them in the
      Report Menu).  Then it will
      print a disturbance report
      every time a power disturbance
      occurs.

   5) Press the SELF CALIBRATE key
      to calibrate your PowerScope.
      The PowerScope has the ability
      to completely calibrate itself.
      A Calibration Report will be
      printed automatically, showing
      the calibration of all of the
      ranges on all of the channels.

   6) Press the SELF TEST key to test
      the PowerScope.

(There is no more HELP!)
```

Wave shp: 0.1 cycles

Range: 0.1 cycles to
9.9 cycles

Use the number keys to enter the minimum duration for waveshape faults.

A typical value is 0.2 cycles. The acceptable range is 0.1 cycles to 9.9 cycles.

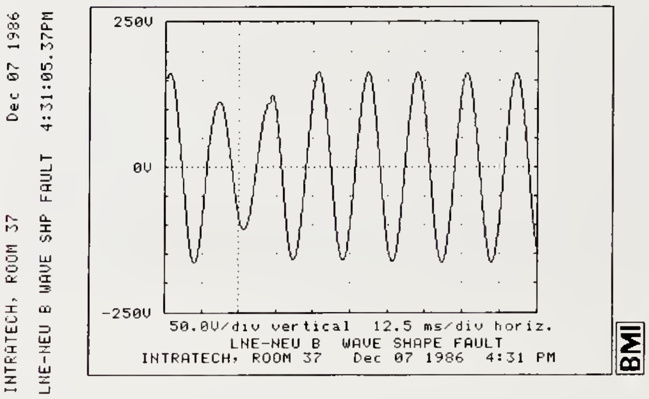


A waveshape fault that is shorter than the minimum duration that you enter here will not trigger a waveshape fault graph; a waveshape fault that is longer than the minimum duration will.

Wave tolerance: 10%

Range: 2% to 99%

Use the number keys to enter the minimum amplitude of waveshape faults as a percentage of full scale.



The range is 2% to 99%. A typical value is 20%. Waveshape faults are detected by comparing each sinewave to the one previous.

HELP!

```
Use the number keys to enter the
minimum waveshape fault duration.

The PowerScope will measure the
instantaneous voltage of a fraction of
an ac cycle and compare it to the same
part of the previous cycle.  This step
of the Setup procedure asks you to
select the minimum duration of
waveshape faults to the nearest 0.1
cycle.  You may select any duration
from 0.1 cycle to 9.9 cycles.  A
reasonable value is 0.2 cycles.

(Press HELP! again for general infor-
mation on the Key Operator menu.)
```

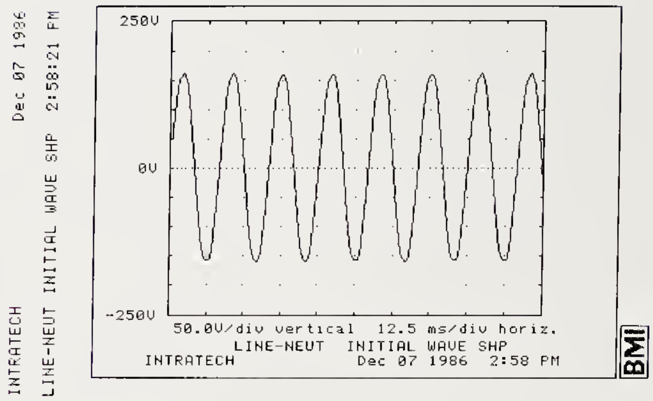
```
Use the number keys to enter the
waveshape fault tolerance.

The PowerScope will measure the
instantaneous voltage of a fraction
of an ac cycle and compare it to the
same part of the previous cycle.  This
question asks you to decide how much,
as a percentage of full scale, the
measurement has to change to produce
a Wave Shape Disturbance Report.  You
may select any percentage from 2% to
99%.  A reasonable value is 10%.

(Press HELP! again for general infor-
mation on the Key Operator Menu.)
```

Wave Res: 5.0 ms/div

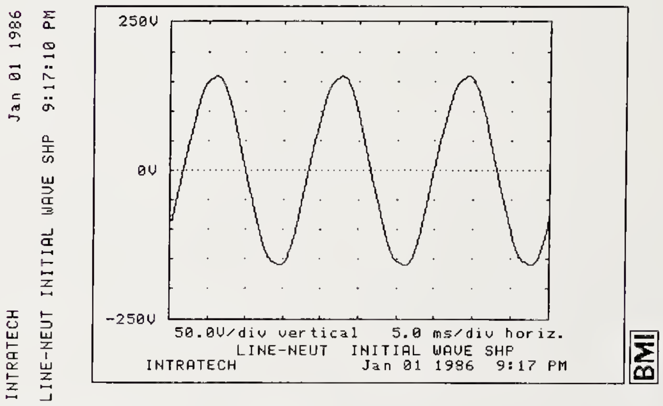
Selections: 5.0 ms/div
12.5 ms/div

Use the VALUE UP/ VALUE DOWN keys to select either high or normal resolution for waveshape fault graphs and initial waveshape graphs.

High resolution prints 5.0 ms/division and normal resolution prints 12.5 ms/division. The difference between the two are shown here.



12.5 ms/division resolution.



5.0 ms/division resolution.

HELP!

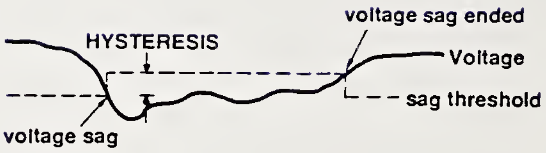
```
Use the VALUE UP/VALUE DOWN keys to
select either high or normal
resolution for waveshape fault and
initial waveshape graphs.

High resolution prints 5.0 ms/division
and normal resolution prints 12.5
ms/division.

(There is no more HELP!)
```

Hysteresis: 1.0%

Range: 0.0% to 5.0%

Use the number keys to enter the hysteresis as a percentage of full scale.

The acceptable range is 0.0% to 5.0%. A typical value is 1.0%.



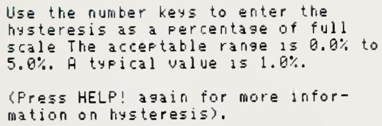
When using hysteresis, the thresholds are altered as indicated by the dashed line (- - -).

Hysteresis is an amount by which a threshold is altered in order to suppress disturbance graphs that would otherwise be triggered by small fluctuations in the measured signal.

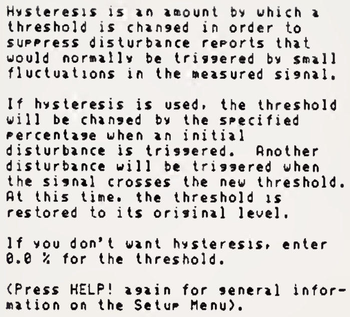
If hysteresis is used, the threshold is altered by the specified percentage after an initial disturbance is triggered until the signal crosses the altered threshold. At this time, the threshold is restored to its original level. If you don't want hysteresis, enter 0.0% for the threshold.

Hysteresis is applied to thresholds set for probes, voltage, and high-frequency noise.

HELP!


Use the number keys to enter the hysteresis as a percentage of full scale The acceptable range is 0.0% to 5.0%. A typical value is 1.0%.

(Press HELP! again for more information on hysteresis).


Hysteresis is an amount by which a threshold is changed in order to suppress disturbance reports that would normally be triggered by small fluctuations in the measured signal.

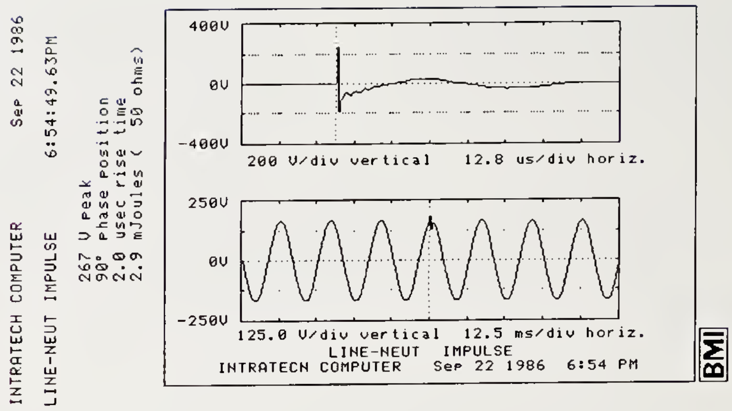
If hysteresis is used, the threshold will be changed by the specified percentage when an initial disturbance is triggered. Another disturbance will be triggered when the signal crosses the new threshold. At this time, the threshold is restored to its original level.

If you don't want hysteresis, enter 0.0 % for the threshold.

(Press HELP! again for general information on the Setup Menu).

Impulse range: Auto

Selections: Auto
Manual



```
INTRATECH COMPUTER          Sep 22 1986
LINE-NEUT IMPULSE           6:54:49.63PM
   267 V peak
   90° phase position
   2.0 usec rise time
   2.9 mJoules ( 50 ohms)
```

Use the VALUE UP/ VALUE DOWN keys to choose automatic or manual impulse ranging.

If you choose automatic impulse ranging, your Power Scope automatically uses your impulse threshold to choose a full-scale range.

Automatic Impulse Ranging Table

If Impulse Threshold selected in previous question is between...	The Impulse Range will set automatically to...
20 - 50 volts	+/- 100 volts
51 - 100 volts	+/- 200 volts
101 - 200 volts	+/- 400 volts
201 - 400 volts	+/- 800 volts
401 - 800 volts	+/- 1600 volts
801 - 1600 volts	+/- 3200 volts
1601- 6000 volts	+/- 6400 volts

However, if you choose manual impulse ranging, your PowerScope will ask you to choose a full-scale range. The choices offered you depend on the selected impulse threshold as follows:

Manual Impulse Ranging Table

Impulse Threshold	Available Full-Scale Ranges
20-24 Vpk	+/-100 or 200 volts full-scale
24-49 Vpk	+/-100, 200 or 400 volts full-scale
50 Vpk	+/-100, 200, 400 or 800 volts full-scale
51-99 Vpk	+/-200, 400 or 800 volts full-scale
100 Vpk	+/-200, 400, 800 or 1600 volts full-scale
101-199 Vpk	+/-400, 800 or 1600 volts full-scale
200 Vpk	+/-400, 800, 1600 or 3200 volts full-scale
201-399 Vpk	+/-800, 1600 or 3200 volts full-scale
400 Vpk	+/-800, 1600, 3200 or 6400 volts full-scale
401-800 Vpk	+/-1600, 3200 or 6400 volts full-scale

In applications where you know the size of impulses that disrupt equipment, it makes sense to choose automatic impulse ranging. In applications where you're trying to characterize a power line, it may make more sense to choose manual impulse ranging, then select the largest full-scale range available.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
choose either AUTOMATIC or MANUAL
selection of full scale impulse
ranges.

(Press HELP! again for more informa-
tion on answering this question).
```

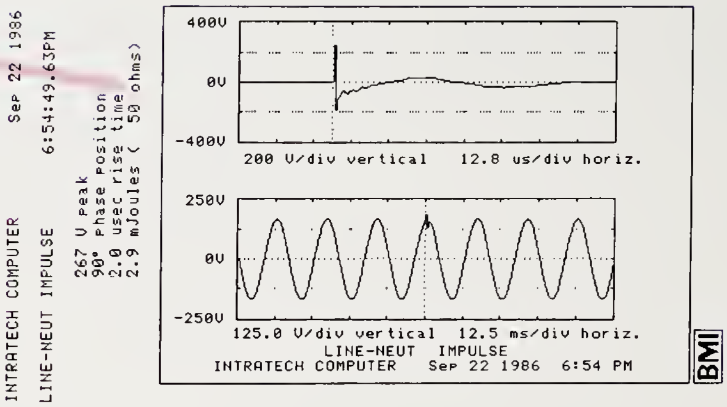
```
If you choose MANUAL selection of
full scale impulse ranges, you will
be asked to choose a full scale range
every time you enter an impulse
threshold.

If you choose AUTOMATIC selection,
the ranges will be selected for you.

(Press HELP! again for a chart showing
the relationship of impulse thresholds
to full scale range when AUTOMATIC
is selected.)
```

```
Impulse threshold  Full Scale Range
-----------------  ----------------
   20 -   50 Vpk        100 Vpk
   51 -  100 Vpk        200 Vpk
  101 -  200 Vpk        400 Vpk
  201 -  400 Vpk        800 Vpk
  401 -  800 Vpk       1600 Vpk
  801 - 1600 Vpk       3200 Vpk
 1601 - 6000 Vpk       6400 Vpk

(Press HELP! again for general
information on the Key Operator
Menu.)
```

Line Imp: 50 ohms

Range: 1 ohms to
9,999 ohms

Use the number keys to enter the estimated impedance of the power line at impulse frequencies.


INTRATECH COMPUTER Sep 22 1986
LINE-NEUT IMPULSE 6:54:49.63PM
267 V peak
90° phase position
2.0 usec rise time
2.9 mJoules (50 ohms)

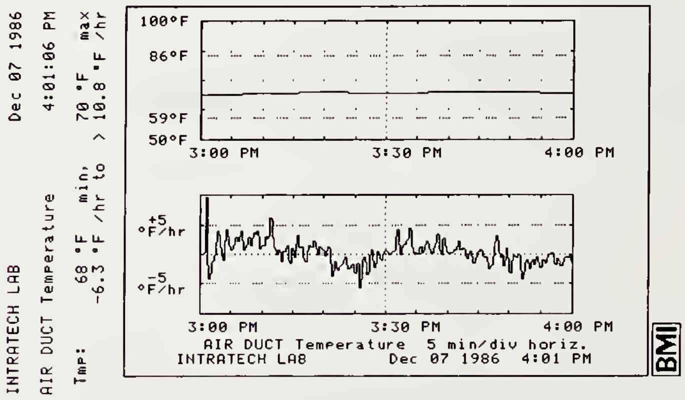
The acceptable range is 1 ohm to 9,999 ohms. Fifty ohms is a reasonable value, unless you are measuring downstream from a power conditioner, where a value of a few hundred ohms is more typical.

The impedance is used in the calculation of approximate impulse energy. It has a second-order effect (the calculation is dominated by the integral of the voltage, which is squared). For a discussion of typical values, see J.H. Bull, “Impedance of the Mains Supply at Radio Frequencies”, Proceedings of the 1st Symposium on EMC, MONTREUX, 75CH1012-4, pp. 357-362, May 1975.

Temp units: F

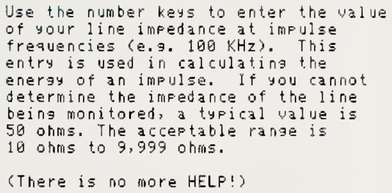
Selections: C
F

Use the VALUE UP/ VALUE DOWN keys to select temperature readings in Centigrade or Fahrenheit.

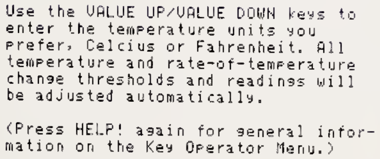

INTRATECH LAB Dec 07 1986
AIR DUCT Temperature 4:01:06 PM
Tmp: 68 °F min, 70 °F max
-6.3 °F /hr to > 10.8 °F /hr

This controls both temperature probes and temperature/humidity probes.

HELP!



```
Use the number keys to enter the value
of your line impedance at impulse
frequencies (e.g. 100 KHz).  This
entry is used in calculating the
energy of an impulse.  If you cannot
determine the impedance of the line
being monitored, a typical value is
50 ohms. The acceptable range is
10 ohms to 9,999 ohms.

(There is no more HELP!)
```



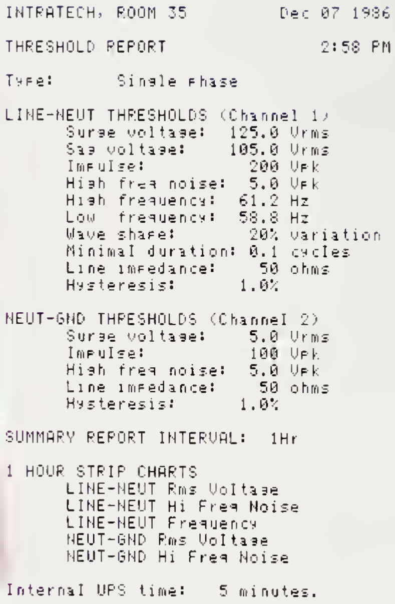
```
Use the VALUE UP/VALUE DOWN keys to
enter the temperature units you
prefer, Celcius or Fahrenheit. All
temperature and rate-of-temperature
change thresholds and readings will
be adjusted automatically.

(Press HELP! again for general infor-
mation on the Key Operator Menu.)
```

Internal UPS: 5 min

Range: 0 min to 15 min

Use the number keys to enter the length of time the internal batteries should support the PowerScope if power fails.

The range is 0 to 15 minutes with fully charged batteries. A typical value is 5 minutes (to capture most disturbances associated with a power failure, yet not consume all battery power during the first power failure that occurs).



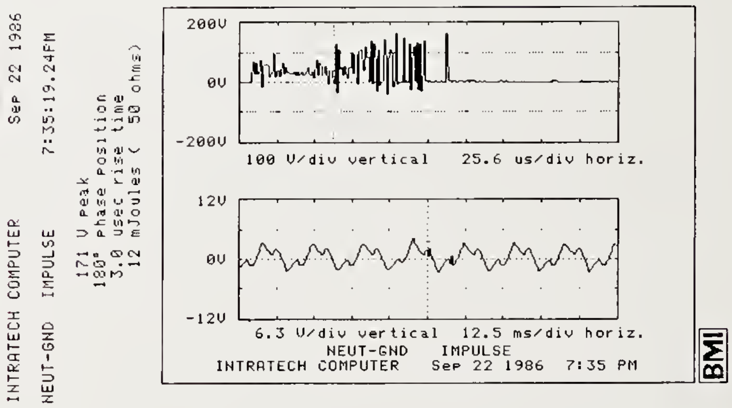
```
INTRATECH, ROOM 35          Dec 07 1986

THRESHOLD REPORT                2:58 PM

Type:      Single phase

LINE-NEUT THRESHOLDS (Channel 1)
      Surge voltage:  125.0 Vrms
      Sag voltage:    105.0 Vrms
      Impulse:          200 Vpk
      High freq noise:  5.0 Vpk
      High frequency:  61.2 Hz
      Low  frequency:  58.8 Hz
      Wave shape:       20% variation
      Minimal duration: 0.1 cycles
      Line impedance:    50 ohms
      Hysteresis:      1.0%

NEUT-GND THRESHOLDS (Channel 2)
      Surge voltage:    5.0 Vrms
      Impulse:          100 Vpk
      High freq noise:  5.0 Vpk
      Line impedance:    50 ohms
      Hysteresis:      1.0%

SUMMARY REPORT INTERVAL:  1Hr

1 HOUR STRIP CHARTS
      LINE-NEUT Rms Voltage
      LINE-NEUT Hi Freq Noise
      LINE-NEUT Frequency
      NEUT-GND Rms Voltage
      NEUT-GND Hi Freq Noise

Internal UPS time:   5 minutes.
```

The PowerScope uses its batteries only while it's monitoring; a power failure while you're setting up your PowerScope will cause a simple power-down procedure.

Current month: Sep

Range: Jan to Dec

Use the VALUE UP/ VALUE DOWN keys to select the current month.



```
INTRATECH COMPUTER       Sep 22 1986
NEUT-GND  IMPULSE     7:35:19.24PM
     171 V peak
    180° phase position
     3.0 usec rise time
      12 mJoules ( 50 ohms)
```

HELP!

Use the number keys to enter the number of minutes the internal batteries should support the PowerScope after a power failure.

The PowerScope's internal batteries will provide full operation for up to 15 minutes during a power failure, after which it goes to a standby condition with the clock and memories maintained. If you plan on frequent power failures, you may wish to enter a shorter UPS (Uninterruptable Power Supply) time.

The acceptable range is 0 to 15 minutes. A typical value is 5 minutes.

(The internal batteries only provide extended support when the instrument is in the Monitor mode.)

(Press HELP! again for general information on the operating sequence.)

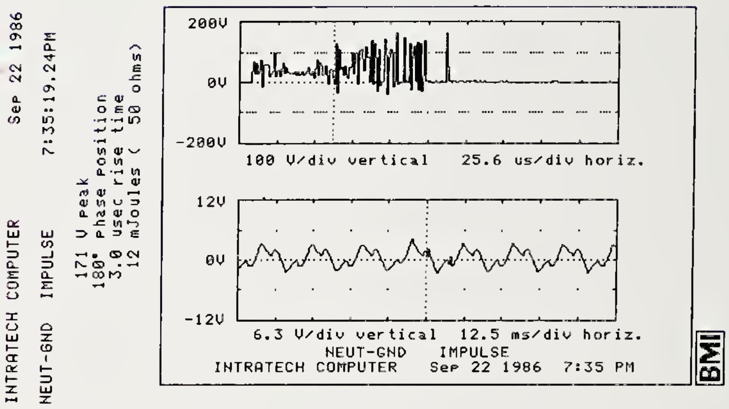
Use the VALUE UP/VALUE DOWN keys to select the current month.

(Press HELP! again for general information on the Key Operator Menu.)

Day of month: 22

Range: 1 to 31

Use the number keys to enter the current date.

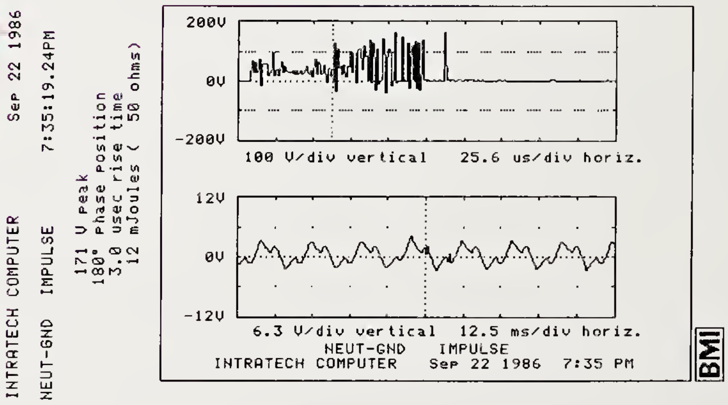


Current year: 1986

Range: 1986 to 2099

Use the number keys to enter the current year.

Acceptable values are 1986 to 2099.



HELP!

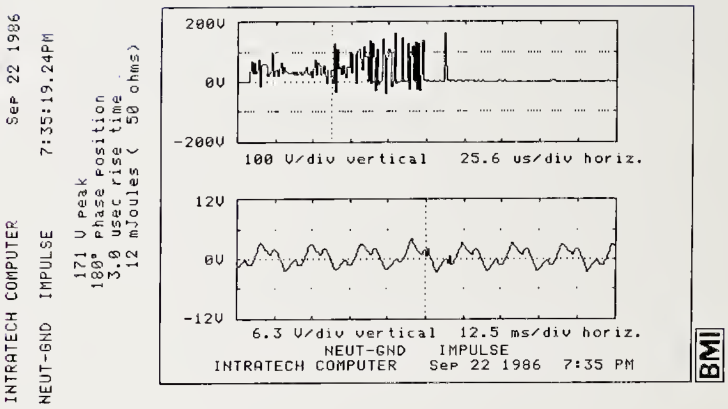
Use the number keys to enter the current date. The acceptable range is from 1 to 31.

Use the number keys to enter the current year. Use four digits (e.g. 1986). The acceptable range is 1986 - 2899.

(Press HELP! again for general information on the operating sequence.)

Date: U.S. standard

Selections: U.S. standard
Eur. standard

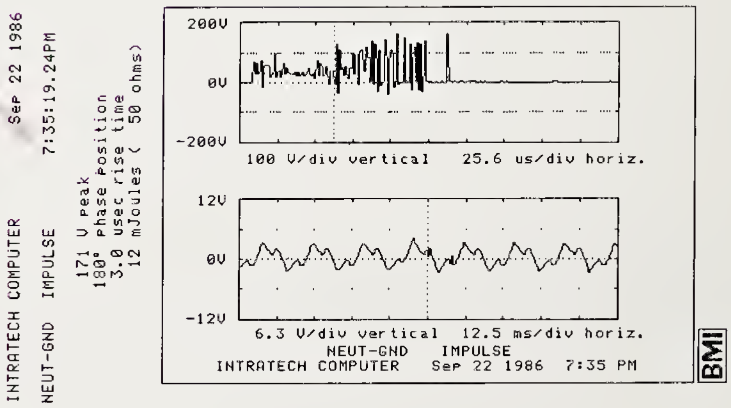


Use the VALUE UP/ VALUE DOWN keys to select the date format you prefer.

The U.S. standard form is January 12, 1987; the European standard for the same date is 12 January, 1987.

Current hour: 7

Range: 0 to 23



Use the number keys to enter the current hour on a 24 hour clock.

For example, if it is 6:00 in the evening, you must enter 18 here. The acceptable range is 0 to 23.

HELP!

Use the VALUE UP/VALUE DOWN keys to select either European format:

DD/MM/YY

or American format:

MM/DD/YY

(There is no more HELP!)

Use the numbers keys to enter the current hour. When setting time of day, ALWAYS enter the hours using 24-hour military-style time. For example, to enter 1:00 PM, enter 13. Later in this menu you have an opportunity to select either AM/PM or 24 HOUR time. The conversions will be made automatically and appear on the printouts that way.

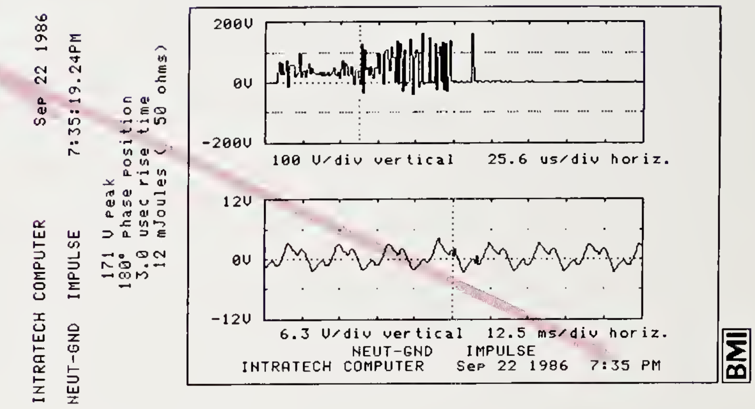
(Press HELP! again for general information on the operating sequence.)

Current minute: 35

Range: 1 to 59

Use the number keys to enter the current minute.

The clock will be set when you step off this question, with the seconds set to zero.



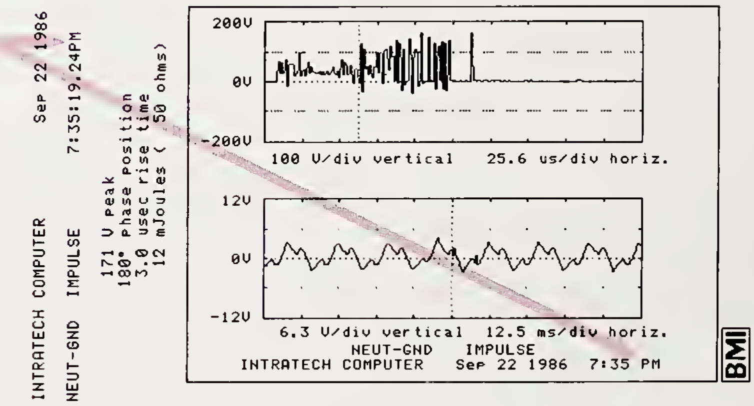
(If you haven't changed the clock, the seconds won't be disturbed.)

Time: AM/PM

Selections: 24 hour
AM/PM

Use the VALUE UP/ VALUE DOWN keys to select A.M./P.M. or military time display.

A.M./P.M. time display would read 7:35PM. Military time display would read 19:35.



HELP!

Use the number keys to enter the time to the nearest minute, 0 to 59.

(Press HELP! again for general information on the operating sequence.)

Use the VALUE UP/VALUE DOWN keys to select either AM/PM or 24-hour military-style time reporting.

(There is no more HELP!)

MEM#1 Name: MEMORY#1

Use the number/letter keypad to name this memory slot.

Usually, you'll want to name it for the type of equipment the setup is used for, e.g. VAX 11/80.

To enter the letter “M”, press the 6MNO key twice. On the first press a 6 will appear, on the second press an M will appear.

Move the flashing cursor to the next position by pressing the right arrow key. Press the 0 SPACE key twice to enter a space.

MEMORY#1: Read/Write

Selections: Read/Write
Read Only

Use the VALUE UP/VALUE DOWN keys to control access to this memory slot.

If you want to ensure the contents of this memory will not change, position Read Only in the display. If you want to be free to store other setups in this memory slot, position Read/Write in the display. Press the down arrow to go on to the next question.

NOTE: The questions on this page are repeated for MEMORY #2 and MEMORY #3.

HELP!

Use the number keys to enter up to 9 characters to name this memory. It's best to name the memory either for the type of equipment being monitored, for example: VAX11/780.

(Press HELP! for additional information on answering this question.)

Use the VALUE UP/VALUE DOWN keys to select whether this memory should be protected or not.

Your choices are READ/WRITE, meaning the memory can be accessed and changed, or READ ONLY, meaning it can't be changed.

(There is no more HELP!)

Use the left and right arrow keys to move the flashing cursor. Use the number keys to enter both letters and numbers. For example, to enter the letter 'b', push the '2ABC' key three times. Then move the flashing cursor to the next character.

(There is no more HELP!)

This chapter describes the operational functions of the PowerScope.

Refer to page x for an overview of how to monitor power with the PowerScope.

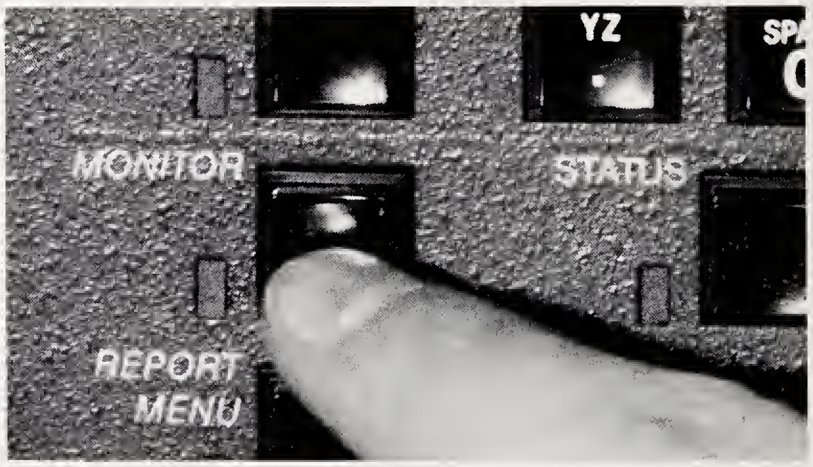
If your PowerScope starts printing graphs right after you plug it in:

These graphs are summary strip charts from the previous monitoring session.

To cancel these reports, press:
- CANCEL PRINTER
- up arrow, and
- any other function key, such as SETUP MENU.

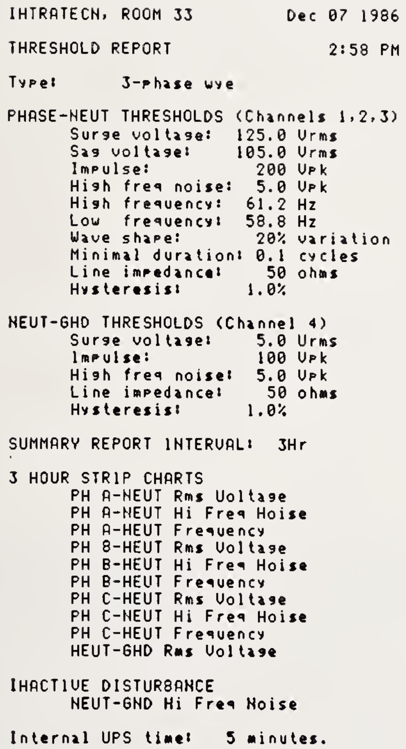
The MONITOR Key

Press the MONITOR key to start monitoring the power line.



Pressing this key will cause the PowerScope to print a Threshold Report and initial waveshape graphs.

Then whenever there's a disturbance, your PowerScope will print a graph of it: impulse graphs, waveshape fault graphs, and summary strip charts. These disturbance graphs are explained on page E-1.

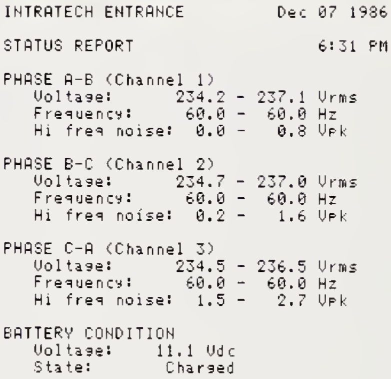


```
INTRATECH, ROOM 33          Dec 07 1986

THRESHOLD REPORT                2:58 PM

Type:      3-phase wye

PHASE-NEUT THRESHOLDS (Channels 1,2,3)
      Surge voltage:  125.0 Vrms
      Sag voltage:    105.0 Vrms
      Impulse:          200 Vpk
      High freq noise:  5.0 Vpk
      High frequency:  61.2 Hz
      Low  frequency:  58.8 Hz
      Wave shape:       20% variation
      Minimal duration: 0.1 cycles
      Line impedance:    50 ohms
      Hysteresis:      1.0%

NEUT-GND THRESHOLDS (Channel 4)
      Surge voltage:    5.0 Vrms
      Impulse:          100 Vpk
      High freq noise:  5.0 Vpk
      Line impedance:    50 ohms
      Hysteresis:      1.0%

SUMMARY REPORT INTERVAL:  3Hr

3 HOUR STRIP CHARTS
      PH A-NEUT Rms Voltage
      PH A-NEUT Hi Freq Noise
      PH A-NEUT Frequency
      PH B-NEUT Rms Voltage
      PH B-NEUT Hi Freq Noise
      PH B-NEUT Frequency
      PH C-NEUT Rms Voltage
      PH C-NEUT Hi Freq Noise
      PH C-NEUT Frequency
      NEUT-GND Rms Voltage

INACTIVE DISTURBANCE
      NEUT-GND Hi Freq Noise

Internal UPS time:   5 minutes.
```

The STATUS Key

Press the STATUS key after you've connected to the power line and before you start monitoring to get a print-out of present voltages and frequencies.

Use the Status Report to determine if the power is live, if you've connected correctly, and to get an idea of how to set your thresholds.

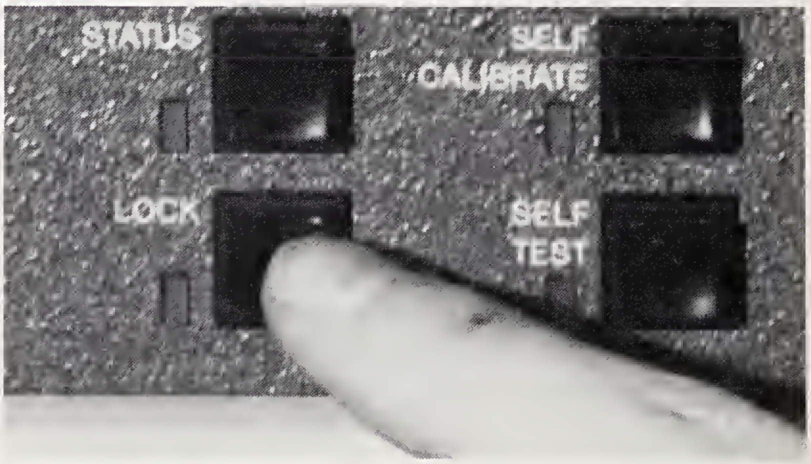


```
INTRATECH ENTRANCE          Dec 07 1986

STATUS REPORT                   6:31 PM

PHASE A-B (Channel 1)
   Voltage:      234.2 - 237.1 Vrms
   Frequency:     60.0 -  60.0 Hz
   Hi freq noise:  0.0 -   0.8 Vpk

PHASE B-C (Channel 2)
   Voltage:      234.7 - 237.0 Vrms
   Frequency:     60.0 -  60.0 Hz
   Hi freq noise:  0.2 -   1.6 Vpk

PHASE C-A (Channel 3)
   Voltage:      234.5 - 236.5 Vrms
   Frequency:     60.0 -  60.0 Hz
   Hi freq noise:  1.5 -   2.7 Vpk

BATTERY CONDITION
   Voltage:    11.1 Vdc
   State:       Charged
```

The LOCK Key

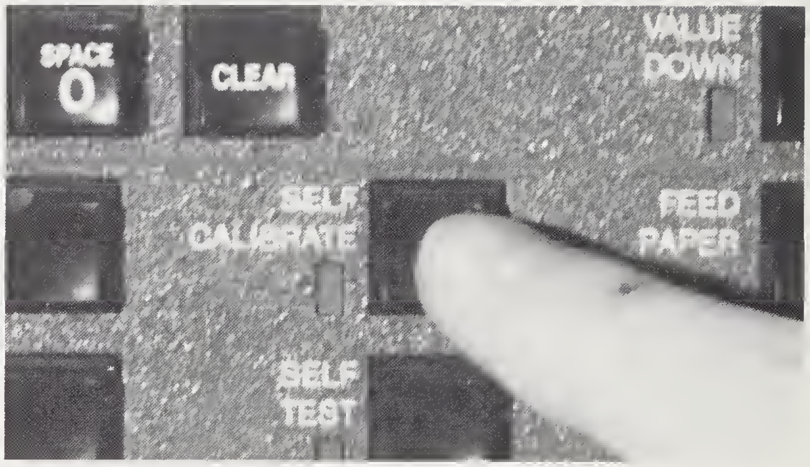
Press the LOCK key if you want to disable the keyboard to guard against casual tampering.

Press the LOCK key then the CLEAR key to unlock the keyboard.



The SELF CALIBRATE Key

Press the SELF CALIBRATE key to get a report indicating the status of the range, noise, offset, stability, and gain for each of the acquisition boards.

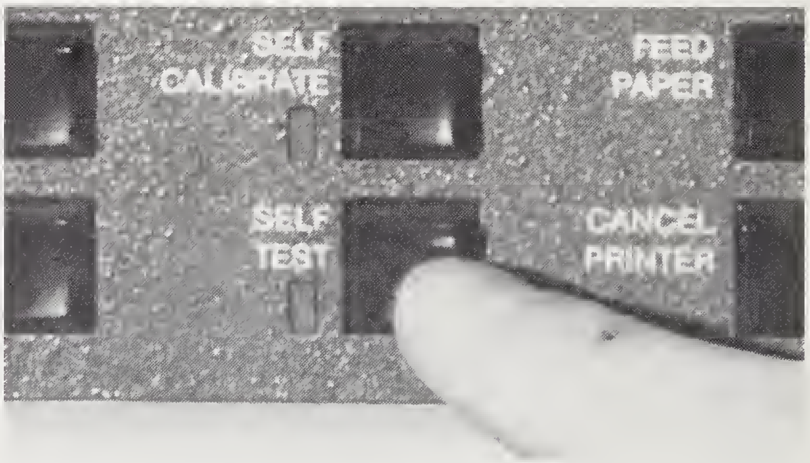


Pressing this key causes the internal calibration module to correct the PowerScope's readings to conform to a very accurate secondary reference voltage source. You must disconnect the monitoring cables before pressing the SELF CALIBRATE key.

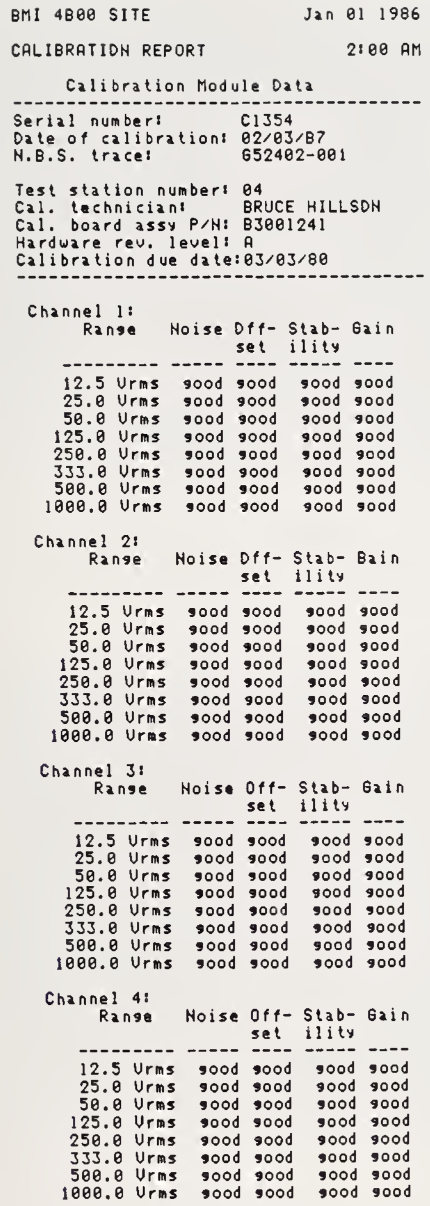
If a “BAD” status appears on the Calibration Report, refer to Chapter 10, Troubleshooting, Page 334. If calibration has expired, contact BMI's Customer Service Department at (415) 570-5355.

The SELF TEST Key

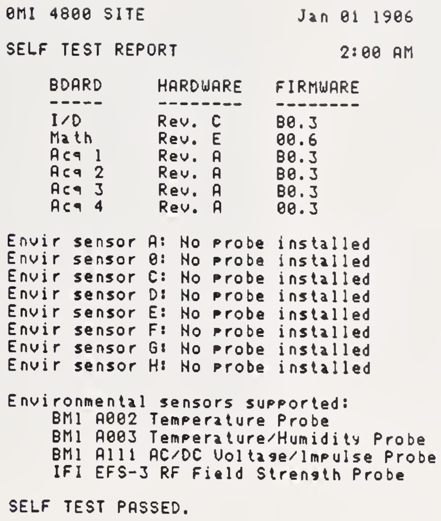
Press the SELF TEST key to get a report verifying the revision level of the software, what boards and probes are installed, and if there is an internal connection problem.



If an unexpected “not installed” message appears on the Self Test Report, refer to Chapter 10, Troubleshooting, Page 334.



```
BMI 4B00 SITE               Jan 01 1986

CALIBRATIDN REPORT              2:00 AM

     Calibration Module Data
---------------------------------------
Serial number:          C1354
Date of calibration: 02/03/B7
N.B.S. trace:           652402-001

Test station number: 04
Cal. technician:        BRUCE HILLSDN
Cal. board assy P/N: B3001241
Hardware rev. level: A
Calibration due date:03/03/80
---------------------------------------

 Channel 1:
      Range     Noise Dff- Stab- Gain
                      set  ility
   --------- ----- ---- ----- ----
    12.5 Vrms  good good  good good
    25.0 Vrms  good good  good good
    50.0 Vrms  good good  good good
   125.0 Vrms  good good  good good
   250.0 Vrms  good good  good good
   333.0 Vrms  good good  good good
   500.0 Vrms  good good  good good
  1000.0 Vrms  good good  good good

 Channel 2:
      Range     Noise Dff- Stab- Bain
                      set  ility
   --------- ----- ---- ----- ----
    12.5 Vrms  good good  good good
    25.0 Vrms  good good  good good
    50.0 Vrms  good good  good good
   125.0 Vrms  good good  good good
   250.0 Vrms  good good  good good
   333.0 Vrms  good good  good good
   500.0 Vrms  good good  good good
  1000.0 Vrms  good good  good good

 Channel 3:
      Range     Noise Off- Stab- Gain
                      set  ility
   --------- ----- ---- ----- ----
    12.5 Vrms  good good  good good
    25.0 Vrms  good good  good good
    50.0 Vrms  good good  good good
   125.0 Vrms  good good  good good
   250.0 Vrms  good good  good good
   333.0 Vrms  good good  good good
   500.0 Vrms  good good  good good
  1000.0 Vrms  good good  good good

 Channel 4:
      Range     Noise Off- Stab- Gain
                      set  ility
   --------- ----- ---- ----- ----
    12.5 Vrms  good good  good good
    25.0 Vrms  good good  good good
    50.0 Vrms  good good  good good
   125.0 Vrms  good good  good good
   250.0 Vrms  good good  good good
   333.0 Vrms  good good  good good
   500.0 Vrms  good good  good good
  1000.0 Vrms  good good  good good
```

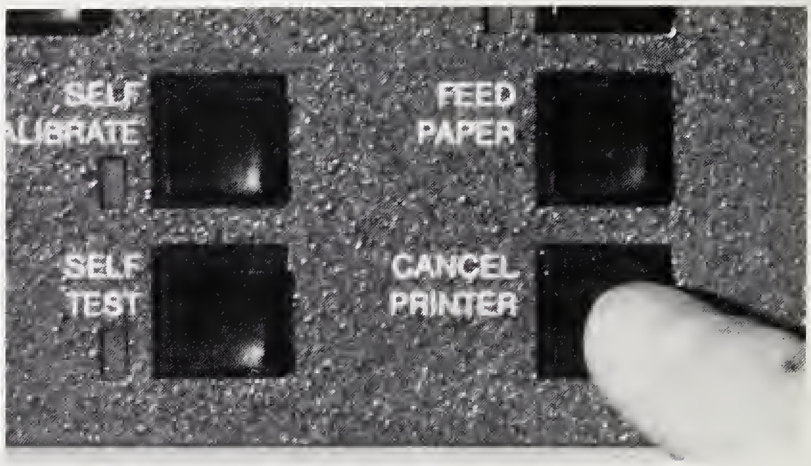


```
0MI 4800 SITE               Jan 01 1906

SELF TEST REPORT                2:00 AM

     BDARD      HARDWARE   FIRMWARE
     -----      --------   --------
     I/D        Rev. C     B0.3
     Math       Rev. E     00.6
     Acq 1      Rev. A     B0.3
     Acq 2      Rev. A     B0.3
     Acq 3      Rev. A     B0.3
     Acq 4      Rev. A     00.3

Envir sensor A: No probe installed
Envir sensor 0: No probe installed
Envir sensor C: No probe installed
Envir sensor D: No probe installed
Envir sensor E: No probe installed
Envir sensor F: No probe installed
Envir sensor G: No probe installed
Envir sensor H: No probe installed

Environmental sensors supported:
     BMI A002 Temperature Probe
     BMI A003 Temperature/Humidity Probe
     BMI A111 AC/DC Voltage/Impulse Probe
     IFI EFS-3 RF Field Strength Probe

SELF TEST PASSED.
```

The CANCEL PRINTER Key

Press the CANCEL PRINTER key to cancel the report that is printing right now.

To cancel all pending reports, press the CANCEL PRINTER key, then immediately press the up arrow.



The STORE MEMORY Key

Store mem: MEMORY #1

Selections: MEMORY #1
MEMORY #2
MEMORY #3
QUIT

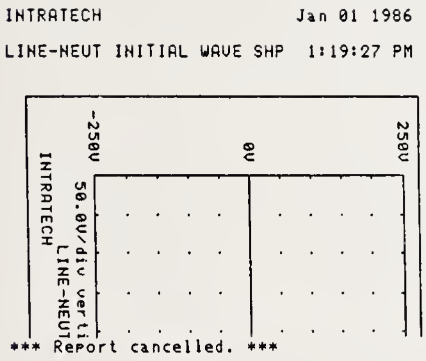
Press the STORE MEMORY key to store the Setup, Report, and Key Operator Menu settings in one of the PowerScope's memories.

This way, you can be ready to monitor for your most common applications with just a few keystrokes.

Use the VALUE UP/VALUE DOWN keys to select which memory the setup will be stored in, then press the down arrow.

If you select QUIT nothing will be stored. If one or all of the memories is missing from the selections, it's because they are protected with a Read Only setting in the Key Operator Menu. (See page 318.) Naming the memories is also a function available in the Key Operator Menu.

Memories are protected even when power is removed.



```
INTRATECH                    Jan 01 1986
LINE-NEUT INITIAL WAVE SHP  1:19:27 PM
```

-250V
0V
250V
50.0V/div verti
INTRATECH
LINE-NEUT

```
*** Report cancelled. ***
```

The RECALL MEMORY Key

Press the RECALL MEMORY key to recall a setup from memory.

When you do this, all the current menu settings are replaced with the settings in memory. When you press the RECALL MEMORY key,
the display will light with:

Recall mem: MEMORY #1

Selections: DEFAULT
MEMORY #1
MEMORY #2
MEMORY #3
QUIT

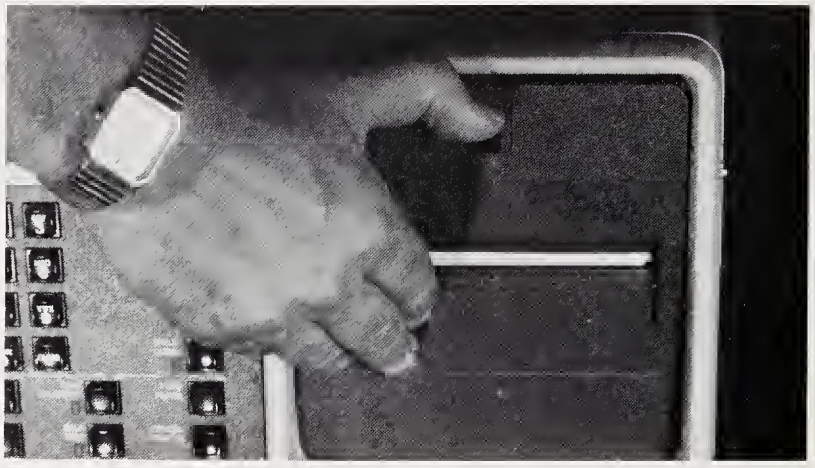
Use the VALUE UP/ VALUE DOWN keys to select the memory you want recalled, then press the down arrow.

If you choose DEFAULT, all default settings for 120 VAC , 60 Hz single-phase power will be restored. If you choose QUIT, nothing will be recalled and your present setup won't be disturbed.

Loading Paper

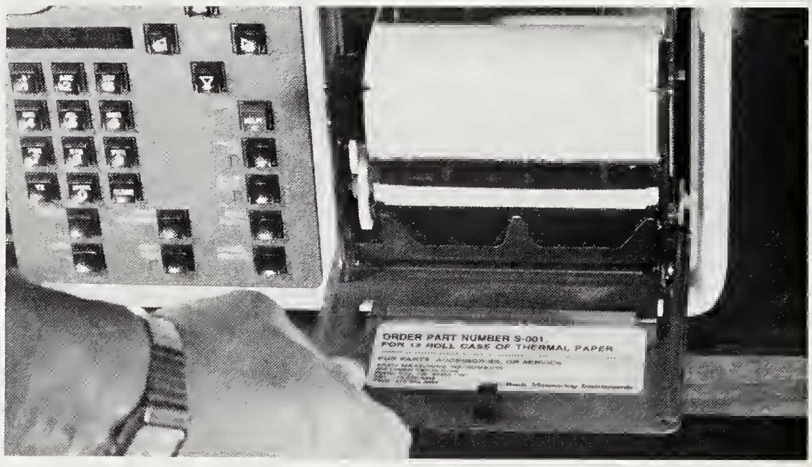
Your PowerScope uses a premium quality thermal paper to produce the best possible graphics from its printer. Order replacement thermal paper rolls, BMI part number S-001, from either your BMI authorized representative, or from the BMI Sales Department at (415) 570-5355.

1. Open the printer door on the PowerScope by unscrewing or pushing down the door releases.

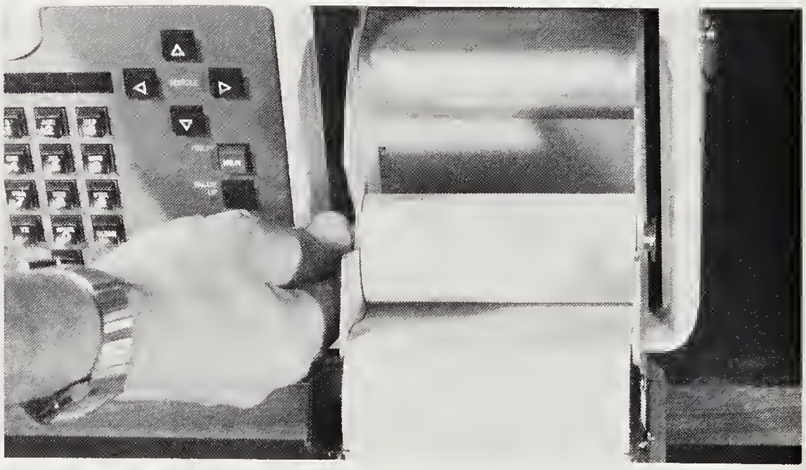


2. Slide the printer out by pulling the printer door towards you.

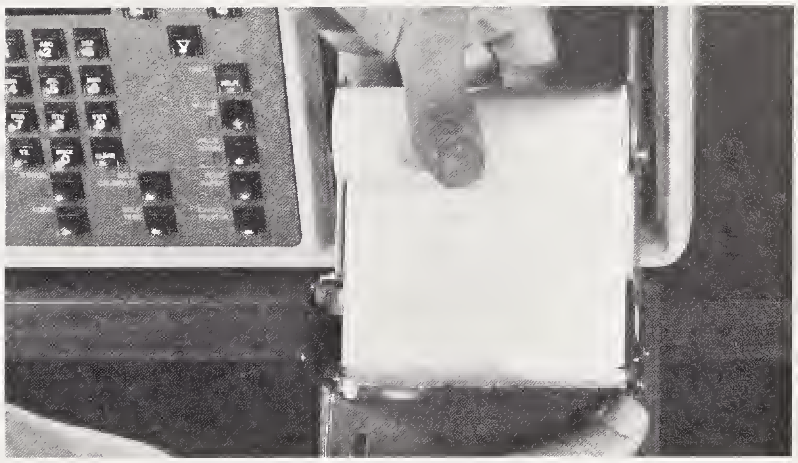
The printer will then pivot downwards to give you better access.



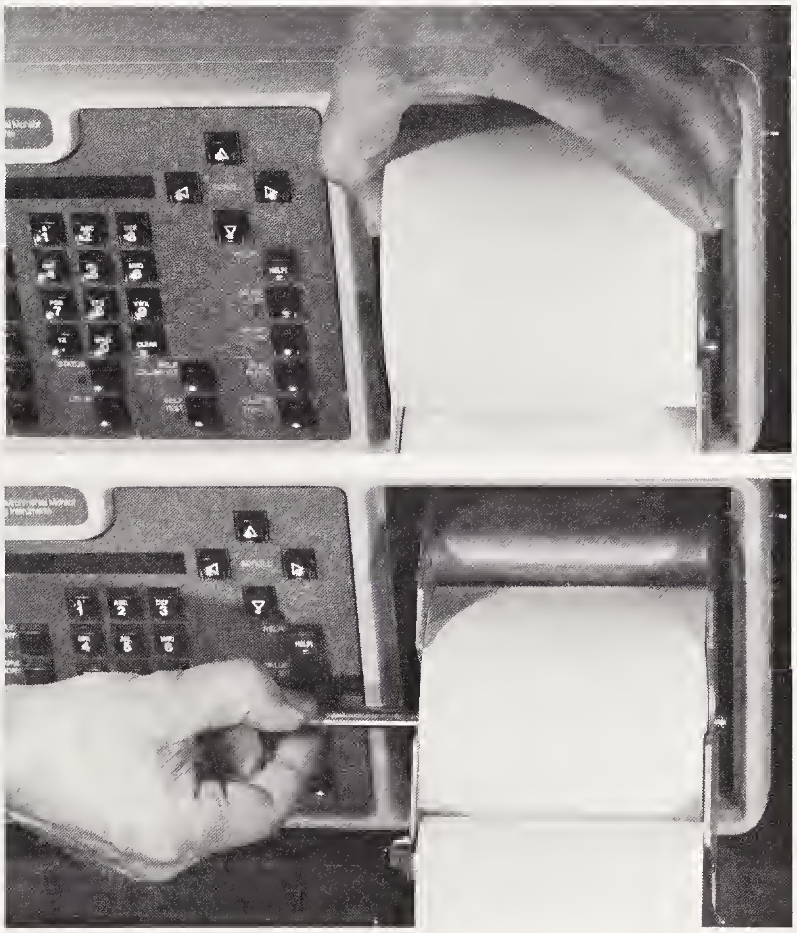
3. Unscrew or unsnap the paper roller.



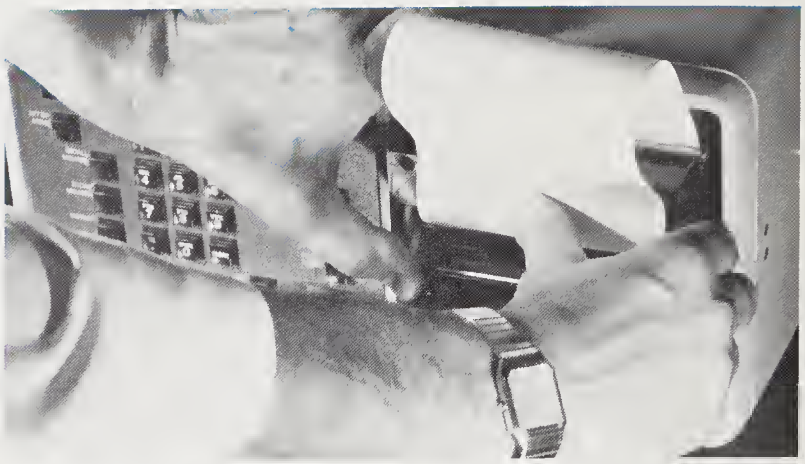
4. Press down on the paper tension release lever, located on the right front side of the printer assembly, and remove the old roll of thermal paper.



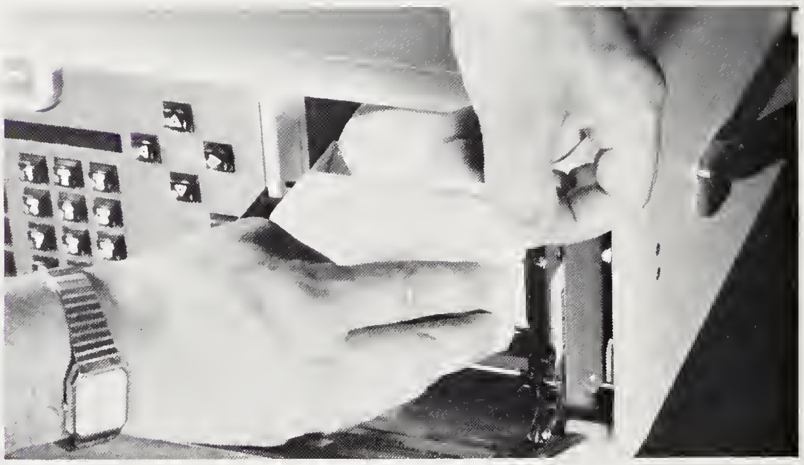
5. Place the new roll of thermal paper in the printer and replace the paper roller.



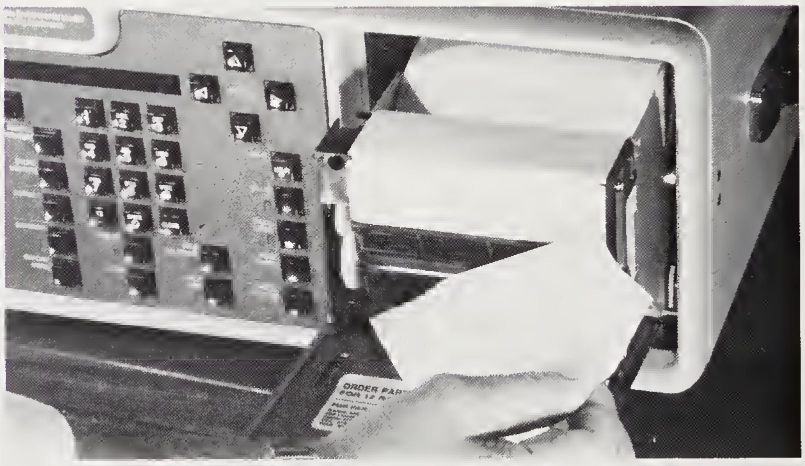
6. Using the paper thread wheel, route the thermal paper over the printer roller, and through the paper feed slot in the printer.



7. Tuck the edges of the paper under the paper guides.



8. Tear the leader off, close the printer door, and press the PAPER FEED key.



NOTE: If your PowerScope won't print, see Chapter 10, Troubleshooting, page 335.

Using the Troubleshooting Chart

Use the Troubleshooting Chart to narrow down the possible causes of any problem with your PowerScope. When there's a couple of possible causes, they'll both be listed with a probability. For example, if you come to a box labelled "Replace I/O Board (80%), or replace Math Board (20%)", replacing the I/O Board will solve the problem eight out of ten times.

Warning
The servicing instructions in this manual are for use by qualified personnel only. To reduce the risk of electrical shock, do not perform any servicing unless you are qualified to do so.

Incoming ground: The power plug is grounded. For continued protection against risk of electrical shock and fire, do not defeat the grounded plug.

Ventilation: This unit is fan cooled. For continued protection against risk of electrical shock and possible fire hazard, do not allow the fan opening to become blocked.

Boards and modules

Math processor	Green handle
Acquisition processor	Blue handle
I/O processor	Red handle
Cal module	On rear of PowerScope; includes fan
Attenuator module	On rear of PowerScope; includes 4 black sockets, 4 red sockets, and 4 green sockets
Mother Board	Large 'L' shaped board at bottom of PowerScope
Printer interface	Small rectangular board at bottom of PowerScope; fits in Mother board 'L'
Front panel board	Small 'L' shaped board; has front panel key switches

Opening your PowerScope

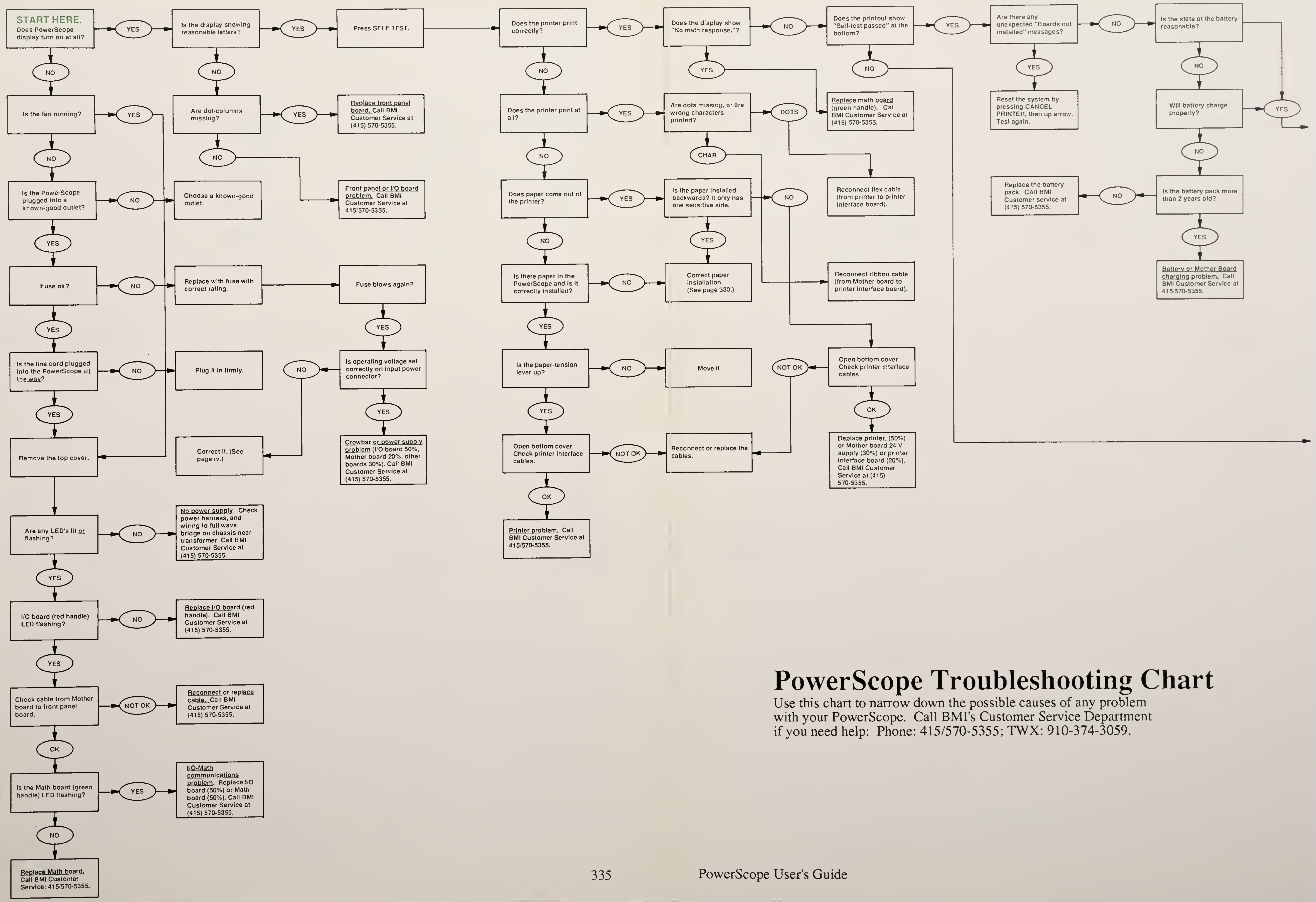
1. Remove the top cover by removing six screws, including one underneath the handle. The cover may catch slightly under the chrome handle trim; free it gently.

2. If necessary, remove the main board clamp (placed across the handles of the boards), and loosen both board edge clamps at the ends of the boards. Slide the board edge clamps away from the boards.

3. If necessary, remove the bottom cover by removing six screws, including one underneath the handle.

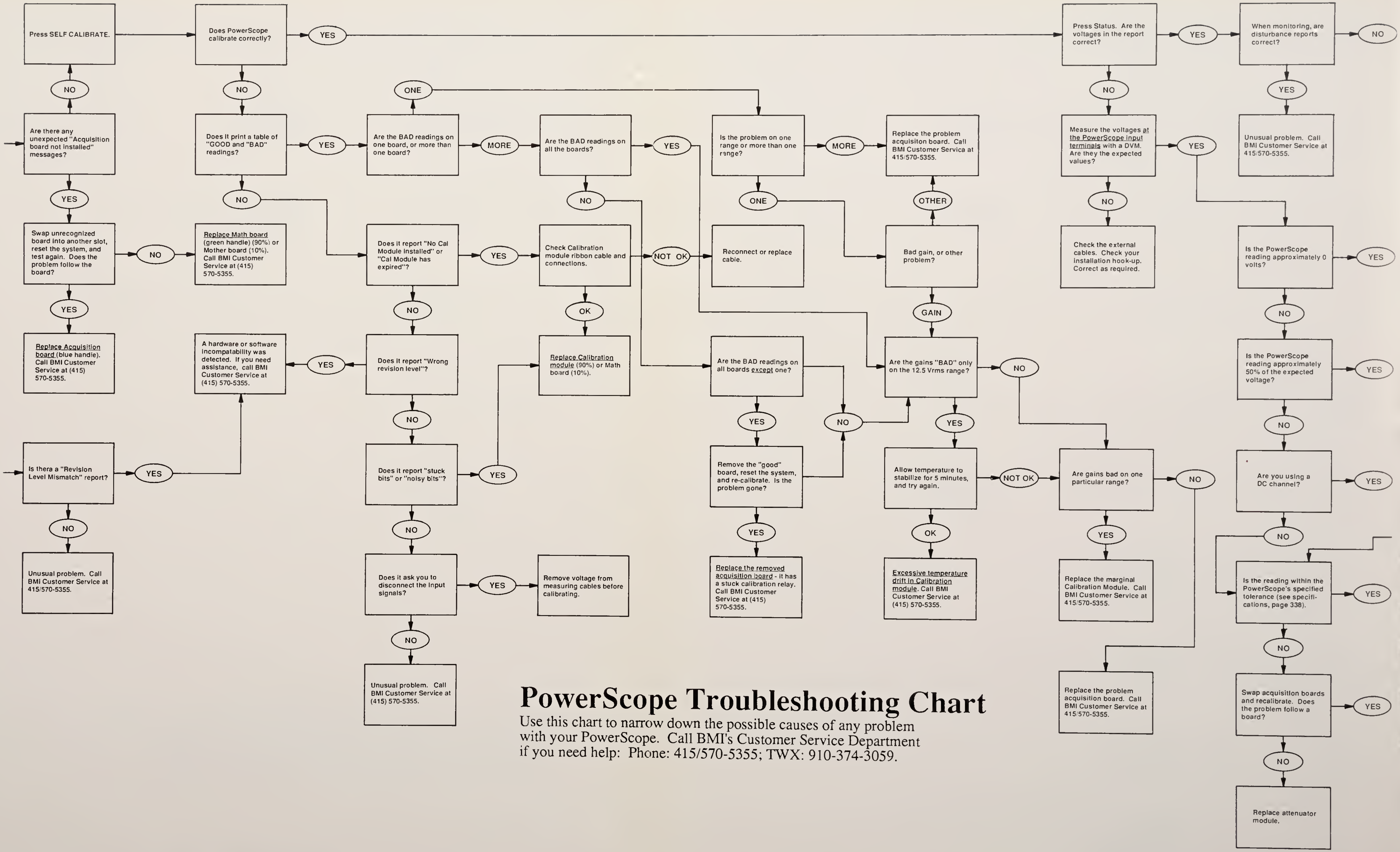
Removing the PowerScope cover.

One screw is located under the handle.


START HERE. Does PowerScope display turn on at all?
YES
NO
Is the fan running?
YES
NO
Is the PowerScope plugged into a known-good outlet?
NO
YES
Fuse ok?
NO
YES
Is the line cord plugged into the PowerScope all the way?
NO
YES
Remove the top cover.
Are any LED's lit or flashing?
NO
YES
I/O board (red handle) LED flashing?
NO
YES
Check cable from Mother board to front panel board.
NOT OK
OK
Is the Math board (green handle) LED flashing?
YES
NO
Replace Math board. Call BMI Customer Service: 415/570-5355.
Is the display showing reasonable letters?
YES
NO
Are dot-columns missing?
YES
NO
Choose a known-good outlet.
Replace with fuse with correct rating.
Plug it in firmly.
Correct it. (See page iv.)
No power supply. Check power harness, and wiring to full wave bridge on chassis near transformer. Call BMI Customer Service at (415) 570-5355.
Replace I/O board (red handle). Call BMI Customer Service at (415) 570-5355.
Reconnect or replace cable. Call BMI Customer Service at (415) 570-5355.
I/O-Math communications problem. Replace I/O board (50%) or Math board (50%). Call BMI Customer Service at (415) 570-5355.
Press SELF TEST.
Replace front panel board. Call BMI Customer Service at (415) 570-5355.
Front panel or I/O board problem. Call BMI Customer Service at 415/570-5355.
Fuse blows again?
YES
Is operating voltage set correctly on input power connector?
NO
YES
Crowbar or power supply problem (I/O board 50%, Mother board 20%, other boards 30%). Call BMI Customer Service at (415) 570-5355.
Does the printer print correctly?
YES
NO
Does the printer print at all?
YES
NO
Does paper come out of the printer?
YES
NO
Is there paper in the PowerScope and is it correctly installed?
NO
YES
Is the paper-tension lever up?
NO
YES
Open bottom cover. Check printer interface cables.
NOT OK
OK
Printer problem. Call BMI Customer Service at 415/570-5355.
Does the display show "No math response."?
NO
YES
Are dots missing, or are wrong characters printed?
DOTS
CHAR
Is the paper installed backwards? It only has one sensitive side.
NO
YES
Correct paper installation. (See page 330.)
Move it.
Reconnect or replace the cables.
Does the printout show "Self-test passed" at the bottom?
YES
NO
Replace math board (green handle). Call BMI Customer Service at (415) 570-5355.
Reconnect flex cable (from printer to printer interface board).
Reconnect ribbon cable (from Mother board to printer interface board).
Open bottom cover. Check printer interface cables.
NOT OK
OK
Replace printer (50%) or Mother board 24 V supply (30%) or printer interface board (20%). Call BMI Customer Service at (415) 570-5355.
Are there any unexpected "Boards not installed" messages?
NO
YES
Reset the system by pressing CANCEL PRINTER, then up arrow. Test again.
Replace the battery pack. Call BMI Customer service at (415) 570-5355.
Is the state of the battery reasonable?
NO
Will battery charge properly?
YES
NO
Is the battery pack more than 2 years old?
NO
YES
Battery or Mother Board charging problem. Call BMI Customer Service at 415/570-5355.

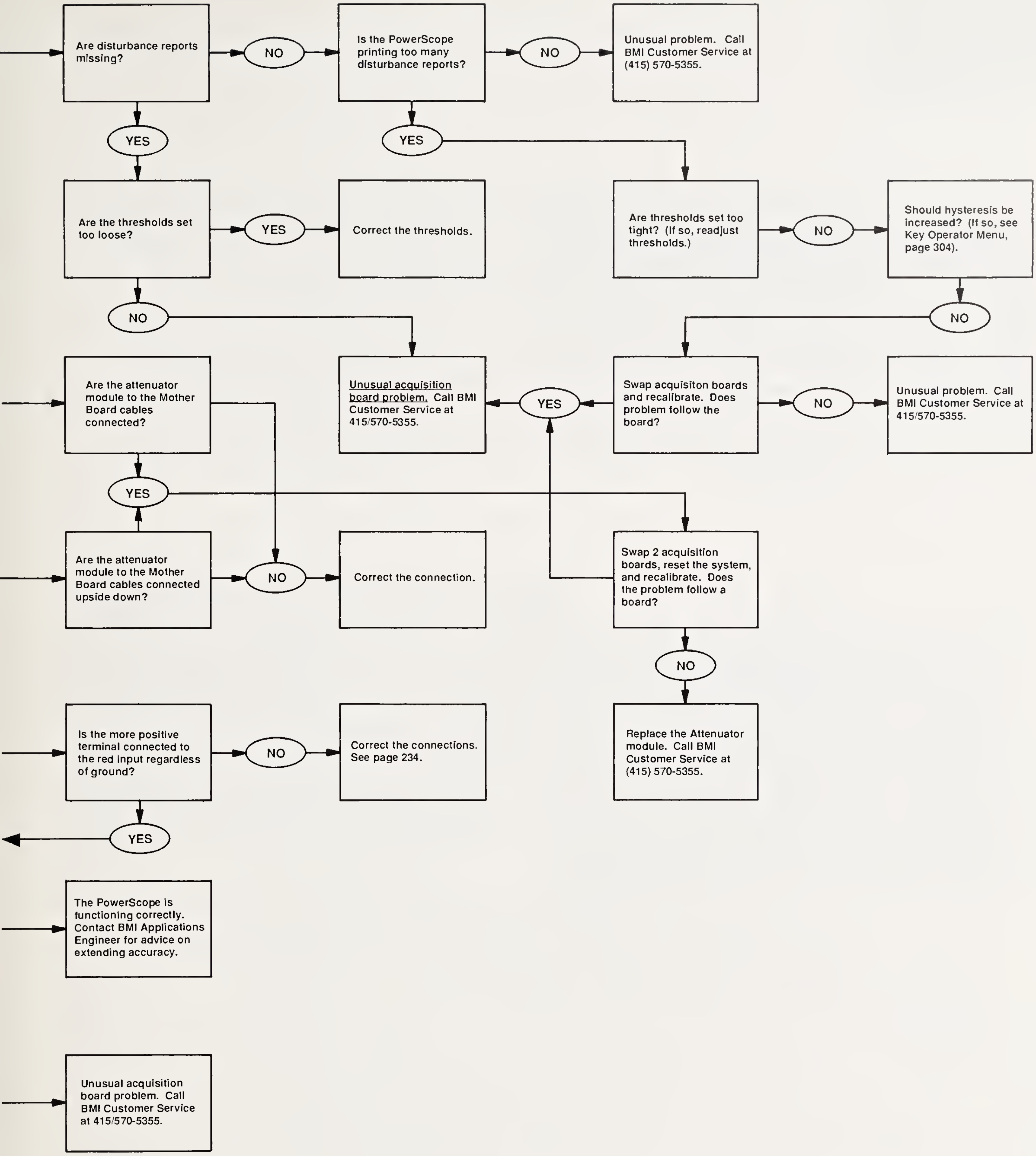
PowerScope Troubleshooting Chart

Use this chart to narrow down the possible causes of any problem with your PowerScope. Call BMI's Customer Service Department if you need help: Phone: 415/570-5355; TWX: 910-374-3059.


Press SELF CALIBRATE.
NO
Are there any unexpected "Acquisition board not installed" messages?
YES
Swap unrecognized board into another slot, reset the system, and test again. Does the problem follow the board?
NO
YES
Replace Acquisition board (blue handle). Call BMI Customer Service at (415) 570-5355.
Is thera a "Revision Level Mismatch" report?
YES
NO
Unusual problem. Call BMI Customer Service at 415/570-5355.
Does PowerScope calibrate correctly?
YES
NO
Does it print a table of "GOOD and "BAD" readings?
YES
NO
Replace Math board (green handle) (90%) or Mother board (10%). Call BMI Customer Service at (415) 570-5355.
A hardware or software incompatability was detected. If you need assistance, call BMI Customer Service at (415) 570-5355.
YES
ONE
Are the BAD readings on one board, or more than one board?
MORE
Does it report "No Cal Module installed" or "Cal Module has expired"?
YES
NO
Does it report "Wrong revision level"?
NO
Does it report "stuck bits" or "noisy bits"?
YES
NO
Does it ask you to disconnect the input signals?
YES
NO
Unusual problem. Call BMI Customer Service at (415) 570-5355.
Remove voltage from measuring cables before calibrating.
Are the BAD readings on all the boards?
YES
NO
Check Calibration module ribbon cable and connections.
NOT OK
OK
Replace Calibration module (90%) or Math board (10%).
Is the problem on one range or more than one range?
MORE
ONE
Reconnect or replace cable.
Are the BAD readings on all boards except one?
YES
NO
Remove the "good" board, reset the system, and re-calibrate. Is the problem gone?
YES
Replace the removed acquisition board - it has a stuck calibration relay. Call BMI Customer Service at (415) 570-5355.
Replace the problem acquisiton board. Call BMI Customer Servica at 415/570-5355.
OTHER
Bad gain, or other problem?
GAIN
Are the gains "BAD" only on the 12.5 Vrms range?
NO
YES
Allow temperature to stabilize for 5 minutes, and try again.
NOT OK
OK
Excessive temperature drift in Calibration module. Call BMI Customer Service at (415) 570-5355.
Press Status. Are the voltages in the report correct?
YES
NO
Measure the voltages at the PowerScope input terminals with a DVM. Are they the expected values?
YES
NO
Check the external cables. Check your installation hook-up. Correct as required.
Are gains bad on one particular range?
NO
YES
Replace the marginal Calibration Module. Call BMI Customer Service at 415/570-5355.
Replace the problem acquisition board. Call BMI Customer Service at 415/570-5355.
When monitoring, are disturbance reports correct?
NO
YES
Unusual problem. Call BMI Customer Service at 415/570-5355.
Is the PowerScope reading approximately 0 volts?
YES
NO
Is the PowerScope reading approximately 50% of the expected voltage?
YES
NO
Are you using a DC channel?
YES
NO
Is the reading within the PowerScope's specified tolerance (see specifications, page 338).
YES
NO
Swap acquisition boards and recalibrate. Does the problem follow a board?
YES
NO
Replace attenuator module.

PowerScope Troubleshooting Chart

Use this chart to narrow down the possible causes of any problem with your PowerScope. Call BMI's Customer Service Department if you need help: Phone: 415/570-5355; TWX: 910-374-3059.



Are disturbance reports missing?

Is the PowerScope printing too many disturbance reports?

Unusual problem. Call BMI Customer Service at (415) 570-5355.

Are the thresholds set too loose?

Correct the thresholds.

Are thresholds set too tight? (If so, readjust thresholds.)

Should hysteresis be increased? (If so, see Key Operator Menu, page 304).

Are the attenuator module to the Mother Board cables connected?

Unusual acquisition board problem. Call BMI Customer Service at 415/570-5355.

Swap acquisiton boards and recalibrate. Does problem follow the board?

Unusual problem. Call BMI Customer Service at 415/570-5355.

Are the attenuator module to the Mother Board cables connected upside down?

Correct the connection.

Swap 2 acquisition boards, reset the system, and recalibrate. Does the problem follow a board?

Is the more positive terminal connected to the red input regardless of ground?

Correct the connections. See page 234.

Replace the Attenuator module. Call BMI Customer Service at (415) 570-5355.

The PowerScope is functioning correctly. Contact BMI Applications Engineer for advice on extending accuracy.

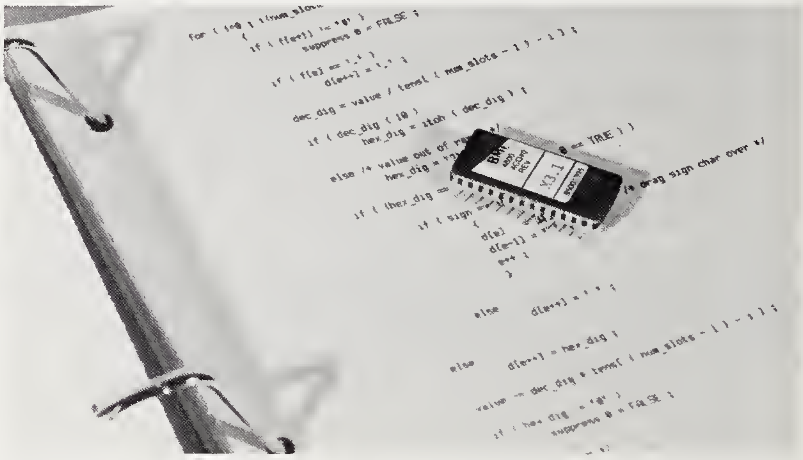
Unusual acquisition board problem. Call BMI Customer Service at 415/570-5355.

General Technical Description

The 4800 PowerScope combines 16 digital oscilloscopes, 32 true RMS voltmeters, 4 frequency meters, 4 noise meters, and up to 16 strip-chart recorders in a compact, lightweight package. All of these instruments are designed for power and environment recording; front panel controls set the triggering thresholds and control the configuration of the instruments.

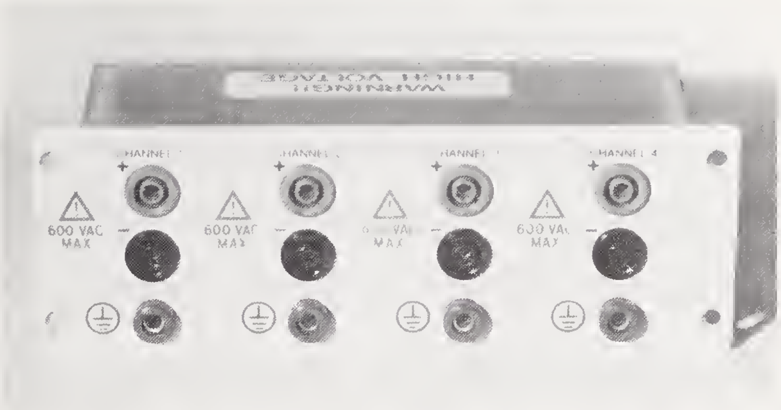
Voltages at the inputs are stepped down by the **Attenuator Module**, then analyzed by the **Acquisition Processors**, which have been previously calibrated by the **Calibration Module**. When an Acquisition Processor detects a disturbance, it passes the raw disturbance data to the **Mathematics Processor**, which analyzes it and sends it to the **I/O Processor**. The final result is sent to the **Printer Interface**, which then sends it to be printed on the **Printer**.

Software



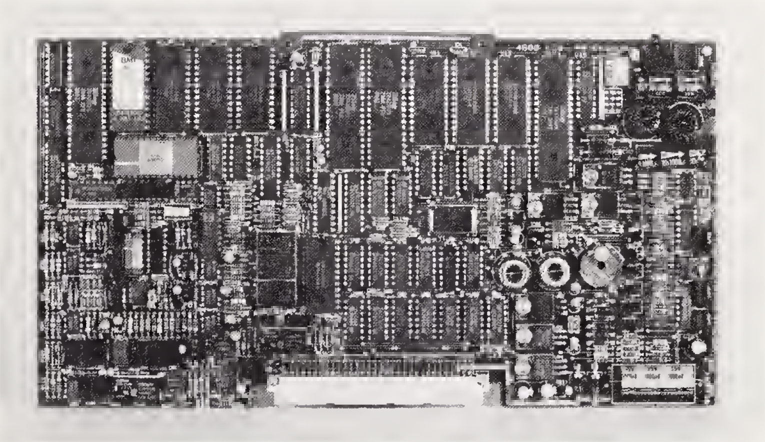
There are six Z-80 microprocessors in each 4800 PowerScope being driven by more than 30,000 lines of code. (Four high-speed custom processors run hard-wired sequences.) The software is stored in EPROM's. Each Z-80 runs an identical real-time, multi-tasking, bank-switching operating system. This operating system controls up to 30 tasks which run simultaneously on each processor, with carefully ranked priority. The operating system also allows critical events to bypass the usual scheduling controls, and tasks can activate and deactivate themselves or other tasks as required. The software is written in “C” and assembly language.

Attenuator Module



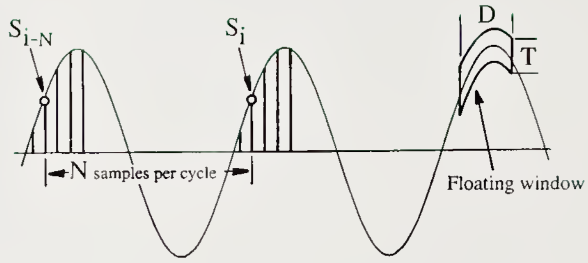
The Attenuator Module accepts high-voltage inputs (up to 600 Vrms, or 6,000 volt impulses) and attenuates then by a factor of 2,048:1. Attenuation for each channel occurs in a separate Faraday-shielded compartment; the differential output is sent through a shielded twisted-pair cable directly to the input of an Acquisition Processor.

Acquisition Processor



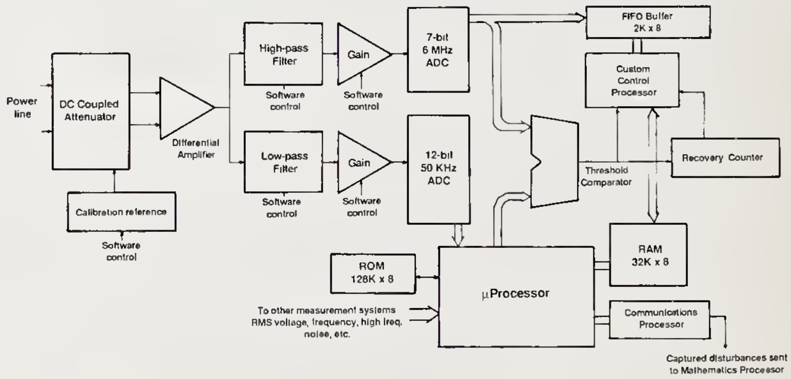
The four Acquisition Processors have blue handles and blue labels on their EPROM's. Each Acquisition Processor is responsible for measuring one channel and two environmental probe inputs. On its assigned input channel, each Acquisition Processor monitors waveshape, true RMS voltage, impulses, frequency, and high-frequency noise. On each assigned environmental probe input, each Acquisition Processor monitors one code voltage that identifies the probe, and two signal voltages. An Acquisition Processor can report on the status of any of its instruments at the request of the Mathematics Processor, or the Mathematics Processor can send thresholds to the Acquisition Processor, which causes the Acquisition Processor to automatically send reports when the thresholds are exceeded. The Mathematics Processor can also configure the Acquisition Processor by setting its RMS voltage range, impulse full-scale range, frequency cut-offs on its filters, input source, sampling rates, etc. Each of the four Acquisition Processors has queue memory for about 10 graphs.

Waveshape Fault Detection



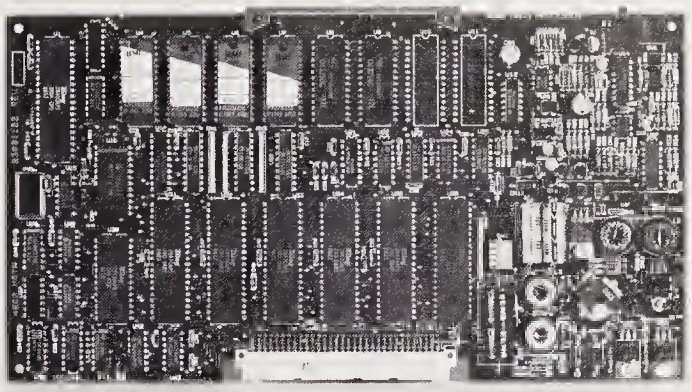
The 4800 PowerScope uses a patented digital technique to detect changes in the shape of the voltage waves that it monitors. The technique is described more fully in a technical paper, available from BMI, titled **A Floating-window Algorithm for Detecting Certain Power Faults That Disrupt Sensitive Electronic Loads.** Basically, the technique digitally samples the waveform, and compares the samples for each cycle to the corresponding samples in the previous cycle. If the samples differ by more than a threshold value (the tolerance) for a threshold length of time (the duration), a waveshape fault graph will be printed. This technique readily identifies sub-cycle drop-outs, addition or removal of substantial harmonic distortion, switching to or from a non-sinusoidal power source, and so on.

Impulse Capture



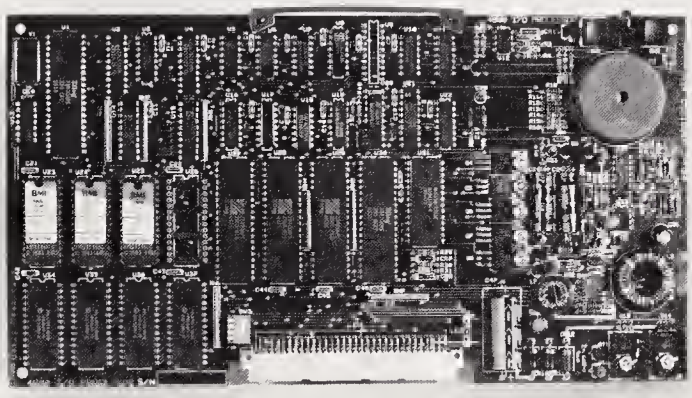
The 4800 PowerScope uses a patented digital system for detecting, capturing, and analyzing impulses on the power line. This system is described more fully in a technical paper, available from BMI, titled **A System for Capturing and Presenting Short-duration Voltage Impulses on AC Power Lines**. Basically, the incoming signal is split into high-frequency and low-frequency components. The low-frequency component is digitally sampled at approximately 20 KHz, and the high-frequency component is digitally sampled at approximately 2.0 MHz (500 nanoseconds). If an impulse appears in the high-frequency section in excess of the user's threshold, pre-trigger and post-trigger samples are captured in both sections for analysis. In a process called decimation, the samples in the high-speed section are examined, and the horizontal display window is adjusted for the best resolution for that particular impulse. The full-scale vertical values for both sections are controlled by software.

Mathematics Processor



The Mathematics Processor has a green handle and green labels on its EPROM's. It is at the center of all the processing in the PowerScope: it is responsible for all of the non-volatile memory, the Set-up and Report Menus, the clock and calendar, and the self-calibration tables. It has queue memory for about 30 graphs. While the instrument is monitoring, the Mathematics Processor periodically requests data from the Acquisition Processors for the strip charts and summary strip chart reports. It also accepts asynchronous raw disturbance reports from the Acquisition Processors; when these reports arrive, the Mathematics Processor performs any necessary math operations on them, scales and formats them, and passes them on to the I/O Processor. The Mathematics Processor is also responsible for testing the complete instrument, and it compiles the Self Test Report.

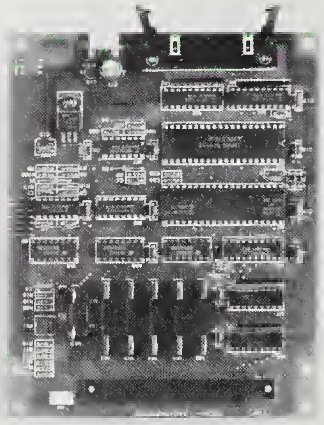
I/O Processor



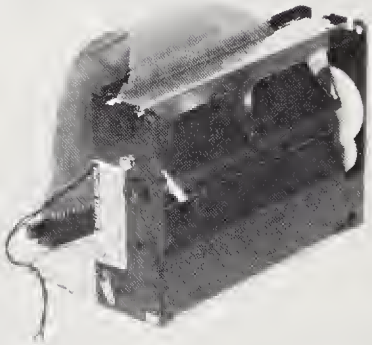
The I/O Processor has a red handle, and red labels on its EPROM's. It is responsible for communicating with the printer interface, the front panel, and the Mathematics Processor (note that the RS-232 port and the modem both talk directly to the Mathematics Processor, not the I/O Processor). It also performs a basic test of the Mathematics Processor when the SELF TEST key is pressed (the Mathematics Processor tests the rest of the instrument). It also holds all of the HELP! messages in all the languages, and has queue memory for about 15 graphs.

Printer Interface

The printer interface board accepts 8-bit parallel characters from the I/O processor, and requires +5V (from the I/O processor to drive the board's local logic) and +24V (from the Mother Board to drive the thermal print head). It controls the printer-advance motor and turns the thermal print elements on and off.

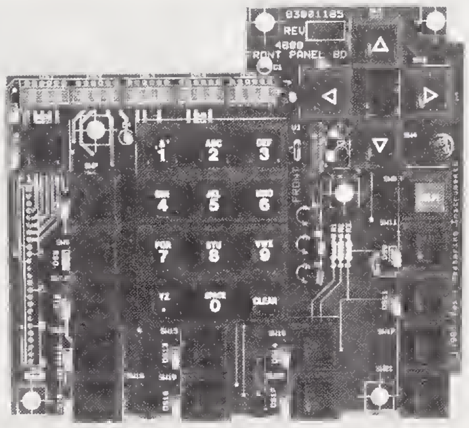


Printer



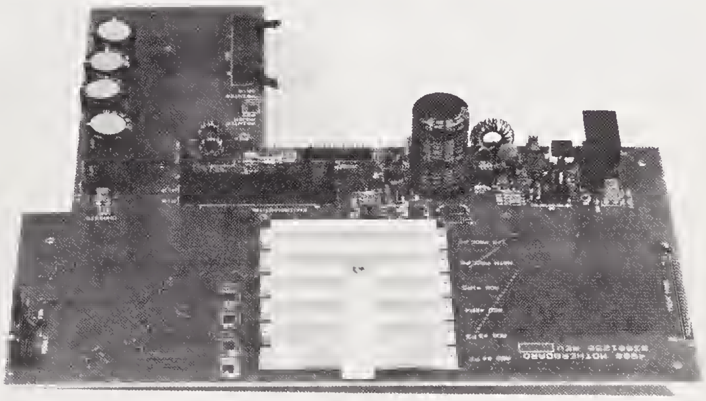
The printer connects directly to the printer interface board through a flexible circuit connector (for the print-head thermal elements and sensors) and a twisted wire pair (for the paper advance motor). The printer has a minimum number of moving parts - the printer head doesn't move - so it is remarkably reliable. A clever thermal strategy allows crisp, clear printing. To maintain print quality you must use the recommended thermal paper.

Front Panel



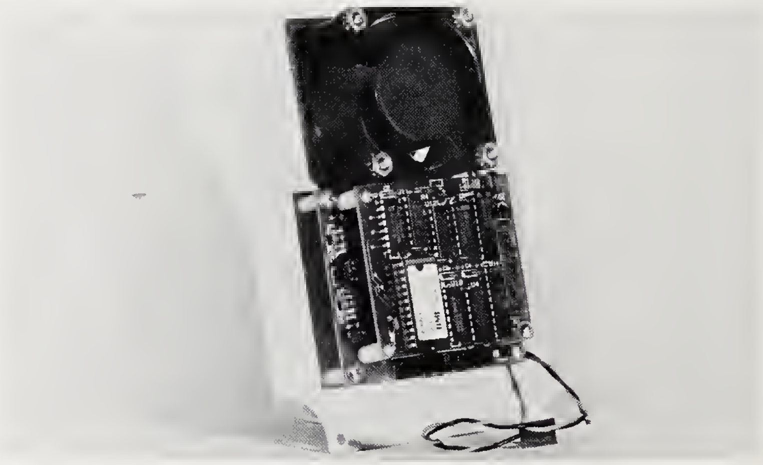
The Front Panel board connects through a 25-wire cable to the Mother Board, where all of the connections are routed directly to the I/O Processor. The Front Panel uses +5V from the I/O Processor. Data for the 20-character display is fed serially for the first 7-dot-column for each of the 20 characters, then displayed, then data for the second dot-column for each of the 20 characters is fed serially and displayed, etc. The keyboard uses a matrix strategy, with the first key depression causing an interrupt. There is 0-key rollover.

Mother Board



The Mother Board is the largest board in the PowerScope. In addition to connecting all of the other boards, it provides filtering, clamping, and crowbarring for the raw DC supply, and generates 24 Vdc for the printer and battery charging circuits. The battery charger and the battery switching relay are also on the Mother Board.

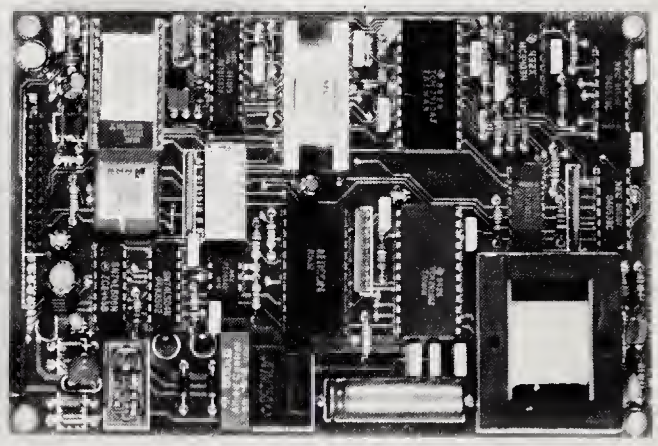
Calibration Module



BMI part number S-002 Calibration Module.

The Calibration Module contains an extremely stable band-gap zener voltage reference, and a laser-trimmed voltage selection array. It is used to provide many different reference voltages which are used to calibrate the instruments on the Acquisition Processors. The Calibration Module includes a calibration EPROM, which contains both a table of corrections for that particular calibration module and the calibration tracing information. This EPROM data must be updated once a year to maintain traceability standards. The Calibration Module, if it has successfully calibrated an Acquisition Processor, causes the BMI logo to be placed at the lower corner of each graph generated by that channel. The Calibration Module is designed to be replaced in the field; annual replacement of the Calibration Module also provides a new fan for the instrument.

Modem



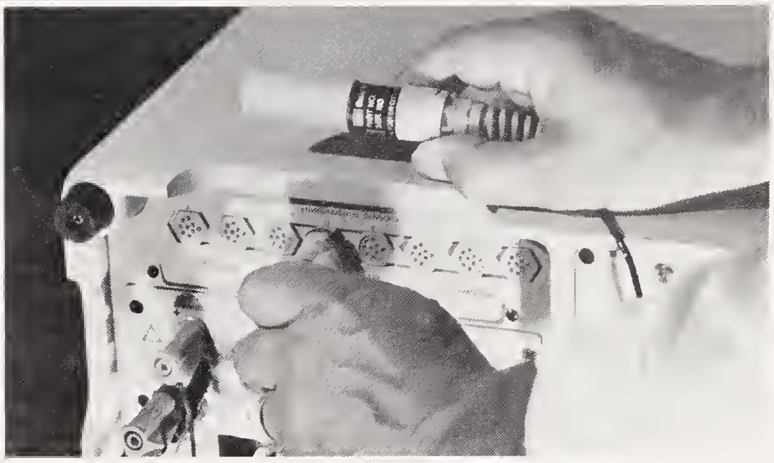
BMI Model number G-006 Auto Dial/Auto Answer 300/1200-Baud Internal Modem.

The optional Modem is an auto-dial, auto-answer, auto-speed modem that operates from 110 baud to 1200 baud. Two RJ-11 jacks are provided, so standard telephone service can be continued when the modem is not using the telephone line.

Operation of the modem is covered in Appendix G.

Temperature Probe

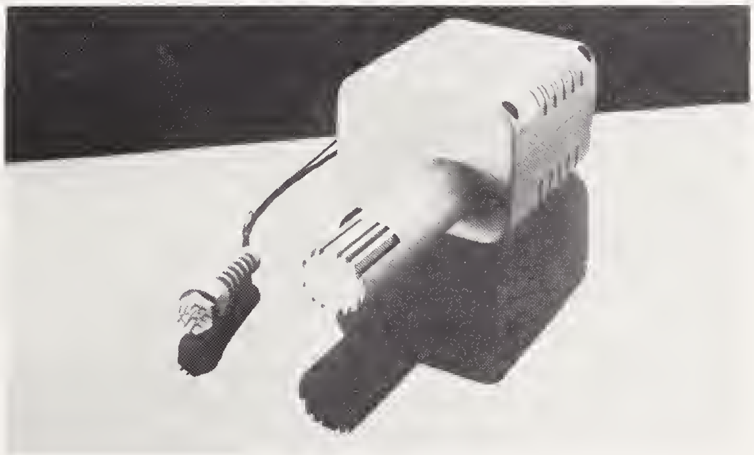
Up to 8 individually-named temperature probes can be supported by a PowerScope. The probes have been optimized for measuring air temperature around electronic systems. A single calibration adjustment is available inside the probe. The probe measures both temperature and rate-of-change in temperature.



BMI Model number A-002 Temperature Probe.

Temperature/ Humidity Probe

Up to 8 individually-named temperature/ humidity probes can be supported by a PowerScope. These probes have also been optimized for measuring air around electronic systems. The temperature/ humidity probe measures temperature, rate-of-change in temperature, humidity, and rate-of-change in humidity.

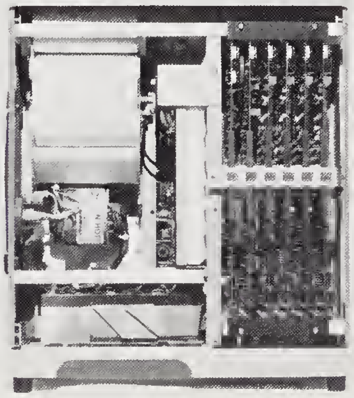


BMI Model number A-003 Temperature/Humidity Probe.

Power Supply

The PowerScope can use three sources of power: AC power, internal NiCad batteries, or an external 12-Vdc supply, such as an automobile battery. Unlike older technology monitors, the AC input power is not connected to any impulse suppression devices, so the instrument can be powered from the same line it is monitoring without affecting the validity of the information. The input AC power feeds a specially constructed toroidal power transformer with 6KV of isolation between any input terminal and ground. Additional shielding is provided to isolate the input of the transformer and the output. The output feeds a simple linear supply; the output of this supply is filtered, then paralleled with the NiCad batteries, then becomes the raw DC supply for the instrument. The raw DC is fed to switching supplies located on each processor board. For analog circuits, these switching supplies feed linear regulators. All power is distributed on power and ground planes; four-layer circuit boards are used throughout. Ground mecca is located at a fast-on terminal on the Mother Board near the rear of the I/O Processor.

Mechanical



The PowerScope was designed from the beginning as a field service instrument; the size constraint was set by what would fit under an airline seat, and the anticipated shock and vibration level was set by the trunk of a rental car. Rugged cast-aluminum front and rear bezels are coupled with extensive internal bracing and clamping. External parts are finished with two-part polyurethane; internal parts are anodized; and all fasteners are chemically locked in place.

General Specifications

4 identical, independent acquisition channels. Each channel can be used for AC, DC, or neutral-to-ground measurements.

Input

Impedance: 4.0 Megohms min., 70 pF max.
Type: Floating differential
Maximum input: 6,400 volts for 1 millisecond, 600 Volts continuous
Common mode rejection: 70 dB @ 100 KHz

AC Measurements

AC Impulses

Input Range	Available Full-Scale Ranges	Typical Accuracy	Maximum Deviation
20 Vpk - 6,400 Vpk	100 Vpk 200 Vpk 400 Vpk 800 Vpk 1,600 Vpk 3,200 Vpk 6,400 Vpk	±3% of reading ±2% of full-scale	5% of reading @300 Vpk w/ 1/2 cycle of 25 KHz superimposed on 120VAC, 60Hz

Input filter: High-pass, 2-pole, 500 Hz (3 dB point) at 50Hz, 60Hz nominal
High-pass, 2-pole, 5 KHz (3 dB point) at 400 Hz nominal
Sampling frequency: 2.0 MHz
Aperture: 0.02 nanoseconds
Display window: 128.0 μseconds, 256.0 μseconds, 512.0 μseconds, or 1.024 milliseconds (software selected after impulse has been captured)

Displayed parameters: phase position, calculated energy, rise time, peak voltage

AC Waveshape Faults

Input Range	Available Full-Scale Ranges
45.0 Hz - 120.0 Hz	Same as RMS voltages

Input filter: Low-pass, 2-pole, 10KHz (3 dB point)
Sampling rate: 2,048 Hz normal resolution; 5,120 Hz high resolution
Detection algorithm: floating-window
Look-back distance: Locked to frequency measurement
Tolerance threshold: User-supplied 1.0% - 99.9% of full scale
Duration threshold: User-supplied; 0.1 cycles - 9.9 cycles

AC RMS Voltages

Sampling rate: 12.8 Hz
Input filter: Low-pass, 2-pole, 10 KHz (3 dB point)
Conversion: True RMS, 100 ms time constant
Threshold hysteresis: User-selected, 0.0% - 5.0%

Input Range	Available Full-Scale Ranges	Typical Accuracy	Maximum Deviation
3.5Vrms - 600.0Vrms	12.5 Vrms 25.0 Vrms 50.0 Vrms 125.0 Vrms 250.0 Vrms 333.0 Vrms 500.0 Vrms 1000.0 Vrms	±0.5% of reading ±0.1Vrms	±1% @120 Vrms, 60 Hz

AC Frequency

Input Range	Available Full-Scale Ranges	Typical Accuracy
45.0 Hz - 450.0 Hz	Adjusted by user-supplied thresholds	±0.1% of reading

Input filter: Low-pass, 2-pole, 10KHz (3 dB point)
Conversion: Digitally integrated for 32 cycles
Output filter: Digital 5-point Bartlett filter

AC High Frequency Noise

Input Range	Available Full-Scale Range	Typical Accuracy	Maximum Deviation
3.0 - 20.0 Vpk-to-pk	20 Vpk-to-pk	±5% of reading ±1.0V	± 5% ±1.0V @10.0V @100KHz superimposed on 120VAC, 60Hz

Input filter: High-pass, 4-pole Butterworth, 10 KHz (3 dB point)
Conversion: Peak detector w/ 100 milliseconds integration
Sampling rate: 12.8 Hz

DC Measurements

DC Voltages

Input Range	Available Full-Scale Ranges	Typical Accuracy	Maximum Deviation
3.0 Vdc - 600.0 Vdc	12.5 Vdc 25.0 Vdc 50.0 Vdc 125.0 Vdc 250.0 Vdc 333.0 Vdc 500.0 Vdc 1000.0 Vdc	±0.5% of reading ±0.1 Vdc	±1% @10 Vdc ±1 0.1 Vdc

Sampling rate: 12.8 Hz
Input filter: Low-pass, 2-pole, 10 KHz (3 dB point)
Conversion: True RMS, 100 ms time constant
Threshold hysteresis: User-selected, 0.0% - 5.0%

DC Waveshape Faults

Input filter: Low-pass, 2-pole, 10KHz (3 dB point)
Sampling rate: 2,048 Hz normal resolution; 5,120 Hz high resolution
Detection algorithm: Floating-window
Look-back distance: Fixed, 5 milliseconds
Tolerance threshold: User-supplied, 1.0% - 99.9% of full-scale
Duration threshold: Fixed, 1 millisecond

DC Impulses

Input Range	Available Full-Scale Ranges	Typical Accuracy	Maximum Deviation
20 Vpk - 6,400 Vpk	100 Vpk 200 Vpk 400 Vpk 800 Vpk 1,600 Vpk 3,200 Vpk 6,400 Vpk	±3% of reading ±2% of full-scale	Same as AC

Input filter: High-pass, 2-pole, 500 Hz (3 dB point)
Sampling frequency: 2.0 MHz
Aperture: 0.02 nanoseconds
Display window: 128.0 µseconds, 256.0 µseconds, 512.0 µseconds, or 1.024 milliseconds (software selected after impulse has been captured)
Displayed parameters: calculated energy, rise time, peak voltage

DC High Frequency Noise

Input Range	Available Full-Scale Range	Typical Accuracy	Maximum Deviation
3.0-20.0 Vpk-to-pk	20 Vpk-to-pk	±5% of reading ±0.1Vdc	Same as AC

Input filter: High-pass, 4-pole Butterworth, 10.0KHz (3 dB point)
Conversion: Peak detector w/ 100 ms integration
Sampling rate: 12.8 Hz

Environmental Probe Input Channels (Generic)

Input Range	Available Full-Scale Ranges	Typical Accuracy	Maximum Deviation
-5.0V - +5.0V	set by probe (0-100°C, 0-100% RH, etc.)	1% of reading	varies with probe type

Code input: -5.0V - +5.0V; identifies type of probe
Sampling rate: 1.0Hz (some probes have peak-hol, trough-hold circuits)
Digital output: Software controlled strobe

Setup Menu Questions

Single Phase Power

(1) Site:
(2) Type: (Power type) Single phase
(3) Nominal frequency
(4) Frequency tolerance
(5) Surge voltage
(6) Sag voltage
(7) Impulse threshold
(8) Impulse range (occurs only if Impulse Ranging is set to MANUAL)
(9) Neutral-to-Ground voltage
(10) Neutral-to-Ground impulse threshold (occurs only if Impulse Ranging is set to MANUAL)
(11) Neutral-to-Ground impulse range
(12) High frequency noise
...There are additional questions if probes are being used ...

Dual Single-Phase Power

(1) Site:
(2) Type: (Power type) Dual 1-phase
(3) Phase setup: A
(4) Nominal frequency
(5) Frequency tolerance
(6) Surge voltage
(7) Sag voltage
(8) Impulse range (occurs only if Impulse Ranging is set to MANUAL)
(9) Impulse threshold
(10) Neutral-to-Ground voltage
(11) Neutral-to-Ground impulse threshold
(12) Neutral-to-Ground impulse ranging (occurs only if Impulse Ranging is set to MANUAL)
(13) Phase setup: B
(14) Nominal frequency
(15) Frequency tolerance
(16) Surge voltage
(17) Sag voltage
(18) Impulse threshold
(19) Impulse range (occurs only if Impulse Ranging is set to MANUAL)
(20) Neutral-to-Ground voltage
(21) Neutral-to-Ground impulse threshold
(22) Neutral-to-Ground impulse ranging (occurs only if Impulse Ranging is set to MANUAL)
(23) High frequency noise
...There are additional questions if probes are being used ...

Three-Phase Delta

(1) Site
(2) Type: (Power type) 3-phase delta
(3) Nominal frequency
(4) Frequency tolerance
(5) Surge voltage
(6) Sag voltage
(7) Impulse threshold
(8) Impulse range (occurs only if Impulse Ranging is set to MANUAL)
(9) High frequency noise
...There are additional questions if probes are being used ...

Three-Phase Wye

(1) Site:
(2) Type: (Power type) 3-phase wye
(3) Nominal frequency
(4) Frequency tolerance
(5) Surge voltage
(6) Sag voltage
(7) Impulse threshold
(8) Impulse range (occurs only if Impulse Ranging is set to MANUAL)
(9) Neutral-to-Ground voltage
(10) Neutral-to-Ground impulse threshold
(11) Neutral-to-Ground impulse range (occurs only if Impulse Ranging is set to MANUAL)
(12) High frequency noise
...There are additional questions if probes are being used ...

Independent Channels

(When Channel 1 is monitoring AC, Channel 2 is monitoring DC, Channel 3 is monitoring N-G, and Channel 4 is turned OFF).

(1) Site:
(2) Type: (Power type) Independent channels
(3) Channel setup: 1
(4) Mode: AC
(5) Name: Channel 1
(6) Nominal frequency
(7) Frequency tolerance
(8) Surge voltage
(9) Sag voltage
(10) Impulse threshold
(11) Impulse ranging (occurs only if Impulse Ranging is set to MANUAL)
(12) High frequency noise
(13) Channel setup: 2
(14) Mode: DC
(15) Name: Channel 2
(16) Surge voltage
(17) Sag voltage
(18) Impulse threshold
(19) Impulse range (occurs only if Impulse Ranging is set to MANUAL)
(20) High frequency noise
(21) Channel setup: 3
(22) Mode: NEUT-GND
(23) Name: Channel 3
(24) Surge voltage
(25) Impulse threshold
(26) Impulse range (occurs only if Impulse Ranging is set to MANUAL)
(27) High frequency noise
(28) Channel setup: 4
(29) Mode: OFF
...There are additional questions if probes are being used ...

Temperature Probe

(1) Sensor setup: B
(2) Name:
(3) Ambient high
(4) Ambient low
(5) Ambient (rate of change)

Radio Frequency Field Strength Probe

(1) Sensor setup: B
(2) Name:
(3) Field B range
(4) Field B surge

Temperature/ Humidity Probe

(1) Sensor setup: B
(2) Name:
(3) Ambient B high
(4) Ambient B low
(5) Ambient B (rate-of-temp change)
(6) Ambient B high (relative humidity)
(7) Ambient B low (relative humidity)
(8) Ambient B (rate of humidity change)

AC/DC/ Impulse Probe

(1) Sensor setup: B
(2) Name:
(3) Sensor mode
(4) Voltage high
(5) Voltage low
(6) Voltage B impulse

Report Menu Questions

Single-Phase

(1) Threshold report
(2) Initial waves
(3) Strip charts
(4) Line-to-Neutral Rms
(5) Line-to-Neutral High Frequency Noise
(6) Line-to-Neutral Frequency
(7) Line-to-Neutral Wave
(8) Line-to-Neutral Impulse
(9) Neutral-to-Ground Rms
(10) Neutral-to-Ground High Frequency Noise
(11) Neutral-to-Ground Impulse
...There are additional questions if probes are being used ...

Dual One-Phase

(1) Threshold report
(2) Initial waves
(3) Strip charts:
(4) Line-to-Neutral A Rms
(5) Line-to-Neutral A High Frequency Noise
(6) Line-to-Neutral A Frequency
(7) Line-to-Neutral A Wave
(8) Line-to-Neutral A Impulse
(9) Neutral-to-Ground A Rms
(10) Neutral-to-Ground A High Frequency Noise
(11) Neutral-to-Ground A Impulse
(12) Line-to-Neutral B Rms
(13) Line-to-Neutral B High Frequency Noise
(14) Line-to-Neutral B Frequency
(15) Line-to-Neutral B Wave
(16) Line-to-Neutral B Impulse
(17) Neutral-to-Ground B Rms
(18) Neutral-to-Ground B High Frequency Noise
(19) Neutral-to-Ground B Impulse
...There are additional questions if probes are being used ..

Three-Phase Delta

(1) Threshold report
(2) Initial waves
(3) Strip charts
(4) Phase A-to-B Rms
(5) Phase A-to-B High Frequency Noise
(6) Phase A-to-B Frequency
(7) Phase A-to-B Wave
(8) Phase A-to-B Impulse
(9) Phase B-to-C Rms
(10) Phase B-to-C High Frequency Noise
(11) Phase B-to-C Frequency
(12) Phase B-to-C Wave
(13) Phase B-to-C Impulse
(14) Phase C-to-A Rms
(15) Phase C-to-A High Frequency Noise
(16) Phase C-to-A Frequency
(17) Phase C-to-A Wave
(18) Phase C-to-A Impulse
...There are additional questions if probes are being used ...

Three-Phase Wye

(1) Threshold report
(2) Initial waves
(3) Strip charts
(4) Phase A-to-Neutral Rms
(5) Phase A-to-Neutral High Frequency Noise
(6) Phase A-to-Neutral Frequency
(7) Phase A-to-Neutral Wave
(8) Phase A-to-Neutral Impulse
(9) Phase B-to-Neutral Rms
(10) Phase B-to-Neutral High Frequency Noise
(11) Phase B-to-Neutral Frequency
(12) Phase B-to-Neutral Wave
(13) Phase B-to-Neutral Impulse
(14) Phase C-to-Neutral Rms
(15) Phase C-to-Neutral High Frequency Noise
(16) Phase C-to-Neutral Frequency
(17) Phase C-to-Neutral Wave
(18) Phase C-to-Neutral Impulse
(19) Neutral-to-Ground Rms
(20) Neutral-to-Ground High Frequency Noise
(21) Neutral-to-Ground Impulse
...There are additional questions if probes are being used ...

Independent Channels

(1) Threshold report
(2) Initial waves
(3) Strip charts
(4) Channel 1 Rms
(5) Channel 1 high frequency noise
(6) Channel 1 frequency
(7) Channel 1 wave
(8) Channel 1 impulse
(9) Channel 2 Vdc
(10) Channel 2 high frequency noise
(11) Channel 2 wave
(12) Channel 2 impulse
(13) Neutral-to-Ground Rms
(14) Neutral-to-Ground high frequency noise
(15) Neutral-to-Ground impulse
...There are additional questions if probes are being used ...

Temperature Probe

(1) Ambient B Temp

Radio Frequency Field Strength Probe	(1) Field B Volts/Meter
Temperature/ Humidity Probe	(1) Ambient B Temperature (2) Ambient B Humidity
AC/DC/ Impulse Probe	(1) Voltage B Rms or Vdc (2) Voltage B impulse

Key Operator Menu Questions

Key Operator Menu

(1) Help (language)
(2) Wave shape
(3) Wave tolerance
(4) Wave resolution
(5) Hysteresis
(6) Impulse ranging
(7) Line impedence
(8) Temperature units
(9) Internal Uninterruptable Power Supply
(10) Current month
(11) Day of month
(12) Current year
(13) Date
(14) Current hour
(15) Current minute
(16) Time AM/PM
(17) Memory #1 name
(18) Memory #1 protect
(19) Memory #2 name
(20) Memory #2 protect
(21) Memory #3 name
(22) Memory #3 protect

Quick Connection Guide

Terminal	Single-phase	Dual 1-phase	3-phase delta
Channel 1 red:	Line	Line A	Phase A
Channel 1 black:	Neutral	Neutral A	Phase B
Channel 1 green:	Earth	Earth	Earth
Channel 2 red:	Neutral	Neutral A	Phase B
Channel 2 black:	Ground	Ground A	Phase C
Channel 3 red:	Not used	Line B	Phase C
Channel 3 black:	Not used	Neutral B	Phase A
Channel 4 red:	Not used	Neutral B	Not used
Channel 4 black:	Not used	Ground B	Not used

WARNING
You are working with high voltages that cause burns and lethal shocks. Connect the safety earth ground first. USE STANDARD SAFETY PRECAUTIONS.

Terminal	3-phase wye	Ind. channels
Channel 1 red:	Phase A	User's option
Channel 1 black:	Neutral	User's option
Channel 1 green:	Earth	Earth
Channel 2 red:	Phase B	User's option
Channel 2 black:	Neutral	User's option
Channel 3 red:	Phase C	User's option
Channel 3 black:	Neutral	User's option
Channel 4 red:	Neutral	User's option
Channel 4 black:	Ground	User's option

WARNING
You are working with high voltages that cause burns and lethal shocks. Connect the safety earth ground first. USE STANDARD SAFETY PRECAUTIONS.

Graphs

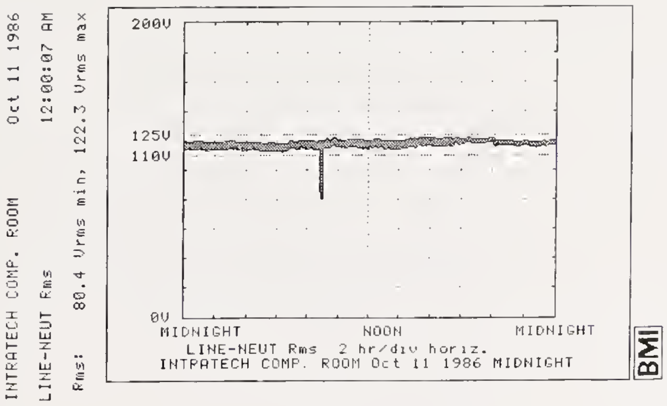
To capture and graph the wide range of disturbances that damage and disrupt electronic equipment, the PowerScope uses several internal measurement systems. The capabilities of each system are independent of the other so you can see even the smallest components of the disturbance at optimum resolution. Each measurement system controls the capture and graphing of four types of power disturbances: long-term disturbances, sags and surges, waveshape faults, and impulses.

Auto zoom

The PowerScope prints four different kinds of graphs corresponding to these disturbances that vary in time duration and resolution: (1) summary strip charts of 1-, 3-, 6-, 12-, or 24-hours, (2) 20-second graphs showing sag or surge disturbances, (3) 125-ms graphs showing waveshape faults, and (4) impulse graphs of varying duration (128 µs, 256 µs, 512 µs, or 1024 µs). The graphs are all the same length physically, but the length of time each pixel or dot on the graph represents varies depending on the length of the disturbance.

Summary Strip Charts

Computer equipment can be disrupted by slowly changing voltage levels that occur over several seconds, minutes, or hours. Disturbances of this kind, such as from the load variation on a utility's distribution grid, are clearly presented on the PowerScope's long term summary strip charts. These summaries report impules, Rms volts, frequency, and high-frequency noise. When optional probes are used, the PowerScope also prints environmental summary strip charts. Summary strip charts are printed at the interval specified by the user in the Report Menu. Strip charts are very helpful when you want to see the overall character of the power, or determine active periods needing closer analysis.



A one-hour summary strip chart showing a voltage sag. If the sag exceeded the programmed threshold, a 20 second sag graph would also be printed.

Strip charts are graphed to show the highest and lowest values that occurred over the sampling period. Both these values are graphed with a vertical pixel-line (the top point on the line represents the highest value, the bottom point on the line the lowest value). The sampling period represented by the pixel line varies depending on the strip chart interval, as does the number of samples taken within the sampling period.

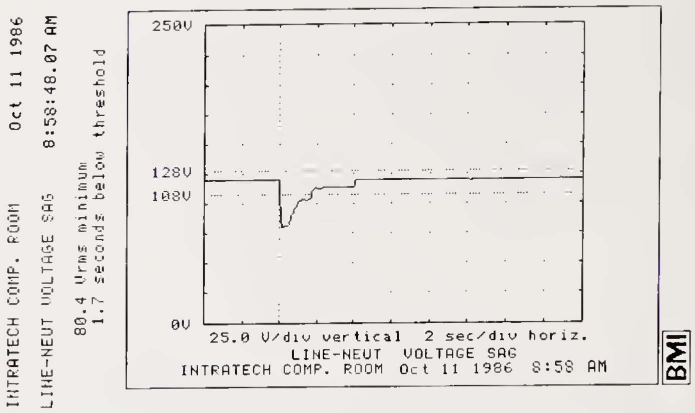
For instance, when making Rms measurements, the PowerScope samples every 78 ms, but for a 1-hour strip chart only reports the highest and lowest values for each 14 second time period. For strip charts showing frequency, the sample rate is every 32 cycles, and for strip charts showing environmental probe measurements, the sample rate is 1 second.

Resolution of Summary Strip Charts

Strip Chart Interval	**Time Per Pixel**	**Samples/Pixel-line**		
		Rms	**Freq**	**Env**
1 hour	14 sec	179	7	14
3 hours	42 sec	538	22	42
6 hours	85 sec	1,090	45	85
12 hours	170 sec	2,179	90	170
24 hours	340 sec	4,359	180	340

Sag/Surge Graphs

Disturbances that have a duration of from 80 ms (5 cycles of 60 Hz power) to several seconds are normally voltage sags and surges. This type of disturbance can be induced by a motor start or stop, for example. The Sag/Surge graphs produced by the PowerScope are 20 seconds long. At this resolution, sags and surges as pictured on a 1-hour summary strip chart are magnified 180 times. Each pixel on a sag/surge graph represents 78 ms.

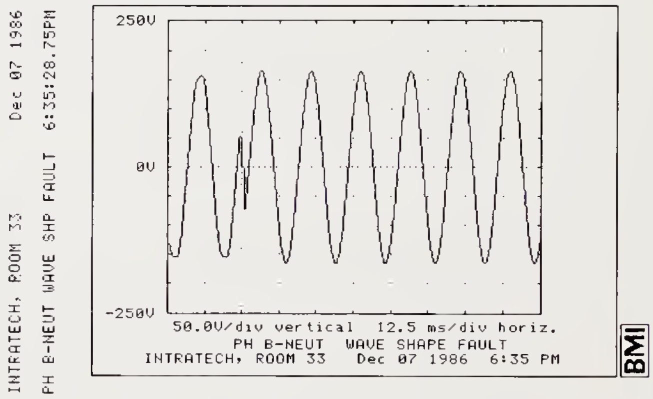


This 20 second sag graph expands the disturbance as shown on a 1 hour strip chart 180 times.

In addition, if the surge (or sag) had a waveshape fault associated with it that exceeded the programmed limits, a waveshape fault graph would be printed by the PowerScope.

Waveshape Fault Graphs

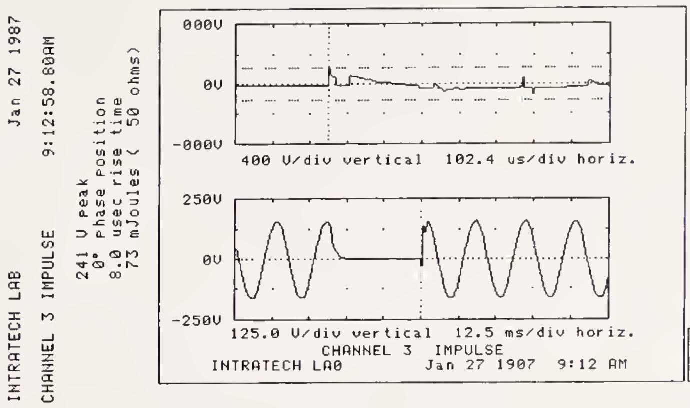
Short disturbances that last between 500 µs (one 30th of a 60 Hz cycle) and 125 ms (7.5 cycles of 60 Hz power) are typically waveshape faults. This type of disturbance can occur, for example, when switching from standby to on-line power. The PowerScope uses a floating window technique to compare a specified percentage of one cycle to the same percentage of the next cycle. The user selects this amplitude deviation percentage. Waveshape fault graphs are 125 milliseconds long, and at this resolution, expand the disturbance as pictured on a one-hour summary strip chart 28,800 times, and as pictured on a 20 second sag/surge graph 160 times. Each pixel on a waveshape fault graph represents 500 µs (except at high resolution, where each pixel represents 200 µs).



Waveshape fault graphs are 125 ms long, showing the disturbance at a very enlarged scale.

Impulse Graphs

Instantaneous power disturbances are impulses. Impulses are caused, for example, from a capacitor switching on line. Impulse graphs are triggered when the voltage exceeds the programmed impulse threshold.



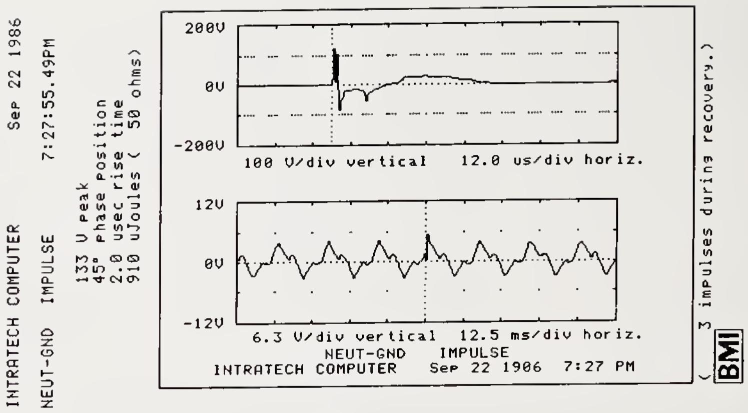
The 1024 µs impulse graph (top) magnifies the impulse shown on the waveshape fault graph (bottom) 125 times.

The PowerScope captures impulses as short as 0.5µs and graphs the disturbance at an appropriate resolution. Impulse graphs are 128 µsec, 256 µs, 512 µs, or 1024 µs in length, and are combined with waveshape fault graphs to show the position of the impulse on the sinewave.

The PowerScope samples impulses at 2MHz and chooses the best sweep rate for data presentation.

Graph Memory

Frequently, many disturbances happen in a short period of time. All power disturbances will be recognized by your PowerScope, which can store as many as 60 graphs. If disturbances occur while the graph memory is full, they will be counted and added to the strip chart report.



INTRATECH COMPUTER Sep 22 1986
NEUT-GND IMPULSE 7:27:55.49PM
133 V peak
45° phase position
2.0 usec rise time
910 uJoules (50 ohms)

(3 impulses during recovery.)

The notation at the far right of this graph indicates how many disturbances occurred while the impulse was being processed. These disturbances are also counted in the strip chart report.

```
INTRATECH, ROOM 33          Dec 07 1986

STRIP CHART REPORT               6:00 PM
 From  3:00 PM  To  6:00 PM

PH A-NEUT  (Channel 1)
 Rms:     91.2 Vrms min, 115.4 Vrms max
 Noise:    0.2 Vpk  min,   1.1 Vpk  max
 Freq:    60.0 Hz   min,  60.0 Hz   max
 Imp:        1 counted,   222  Vpk  max

PH B-NEUT  (Channel 2)
 Rms:     91.2 Vrms min, 115.7 Vrms max
 Noise:    0.0 Vpk  min,   0.3 Vpk  max
 Freq:    60.0 Hz   min,  60.0 Hz   max
 Imp:        0 counted

PH C-NEUT  (Channel 3)
 Rms:     91.0 Vrms min, 115.5 Vrms max
 Noise:    0.0 Vpk  min,   0.8 Vpk  max
 Freq:    60.0 Hz   min,  60.0 Hz   max
 Imp:        1 counted,   337  Vpk  max

NEUT-GND  (Channel 4)
 Rms:      1.4 Vrms min,> 10.0 Vrms max
 Noise:    0.0 Vpk  min,   0.5 Vpk  max
 Imp:        6 counted, > 200  Vpk  max
```

Recommended Thresholds

*NOTE: Use these thresholds to get started **only** if you lack other data about acceptable power for your application.*

	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
ABU DHABI	240 Vrms	50 Hz	1.0 Hz	265 Vrms	204 Vrms	400 Vpk
	415 Vrms	50 Hz	1.0 Hz	457 Vrms	352 Vrms	600 Vpk
AFGHANISTAN	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	414 Vrms	323 Vrms	600 Vpk
ALGERIA	127 Vrms	50 Hz	0.8 Hz	140 Vrms	114 Vrms	200 Vpk
	220 Vrms	50 Hz	0.8 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.8 Hz	419 Vrms	342 Vrms	600 Vpk
ANGOLA	220 Vrms	50 Hz	1.0 Hz	243 Vrms	184 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
ANTIGUA	230 Vrms	60 Hz	1.2 Hz	254 Vrms	195 Vrms	700 Vpk
	400 Vrms	60 Hz	1.2 Hz	441 Vrms	340 Vrms	600 Vpk
ARGENTINA	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	342 Vrms	600 Vpk
	390 Vrms	50 Hz	0.5 Hz	430 Vrms	451 Vrms	600 Vpk
AUSTRALIA	240 Vrms	50 Hz	0.5 Hz	255 Vrms	225 Vrms	400 Vpk
	415 Vrms	50 Hz	0.5 Hz	440 Vrms	390 Vrms	600 Vpk
	440 Vrms	50 Hz	0.5 Hz	467 Vrms	413 Vrms	700 Vpk
AUSTRIA	220 Vrms	50 Hz	0.5 Hz	232 Vrms	209 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	400 Vrms	361 Vrms	600 Vpk
AZORES	220 Vrms	50 Hz	0.5 Hz	232 Vrms	209 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	400 Vrms	361 Vrms	600 Vpk
BAHAMAS	120 Vrms	60 Hz	1.2 Hz	133 Vrms	102 Vrms	200 Vpk
	208 Vrms	60 Hz	1.2 Hz	229 Vrms	176 Vrms	300 Vpk
	240 Vrms	60 Hz	1.2 Hz	265 Vrms	204 Vrms	400 Vpk
	415 Vrms	60 Hz	1.2 Hz	457 Vrms	352 Vrms	600 Vpk
BAHRAIN	110 Vrms	50 Hz	1.0 Hz	117 Vrms	103 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	234 Vrms	206 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	403 Vrms	375 Vrms	600 Vpk
	400 Vrms	50 Hz	1.0 Hz	425 Vrms	376 Vrms	600 Vpk
	110 Vrms	60 Hz	1.2 Hz	117 Vrms	103 Vrms	200 Vpk
	220 Vrms	60 Hz	1.2 Hz	234 Vrms	206 Vrms	400 Vpk
	380 Vrms	60 Hz	1.2 Hz	403 Vrms	357 Vrms	600 Vpk
	400 Vrms	60 Hz	1.2 Hz	425 Vrms	376 Vrms	600 Vpk
BANGLADESH	230 Vrms	50 Hz	2.0 Hz	242 Vrms	218 Vrms	400 Vpk
	400 Vrms	50 Hz	2.0 Hz	421 Vrms	380 Vrms	600 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

NOTE: Use these thresholds to get started ***only*** *if you lack other data about acceptable power for your application.*

	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
BARBADOS	115 Vrms	50 Hz	1.0 Hz	127 Vrms	97 Vrms	200 Vpk
BELGIUM	220 Vrms	50 Hz	0.5 Hz	243 Vrms	187 Vrms	400 Vpk
	240 Vrms	50 Hz	0.5 Hz	255 Vrms	194 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	323 Vrms	600 Vpk
	400 Vrms	50 Hz	0.5 Hz	441 Vrms	324 Vrms	600 Vpk
	415 Vrms	50 Hz	0.5 Hz	440 Vrms	336 Vrms	600 Vpk
BENIN	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
BERMUDA	120 Vrms	60 Hz	0.6 Hz	153 Vrms	102 Vrms	200 Vpk
	208 Vrms	60 Hz	1.0 Hz	229 Vrms	176 Vrms	300 Vpk
BOLIVIA	110 Vrms	50 Hz	1.0 Hz	122 Vrms	93 Vrms	200 Vpk
BOTSWANA	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
BRAZIL	110 Vrms	60 Hz	1.2 Hz	122 Vrms	93 Vrms	200 Vpk
	127 Vrms	60 Hz	1.2 Hz	140 Vrms	107 Vrms	200 Vpk
	220 Vrms	60 Hz	1.2 Hz	243 Vrms	187 Vrms	400 Vpk
BRUNEI	240 Vrms	50 Hz	1.0 Hz	265 Vrms	204 Vrms	400 Vpk
BULGARIA	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
BURMA	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
BURUNDI	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
CAMBODIA	120 Vrms	50 Hz	1.0 Hz	133 Vrms	102 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrm	400 Vpk
CAMEROON	127 Vrms	50 Hz	1.0 Hz	140 Vrms	107 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
CANADA	120 Vrms	60 HZ	0.6 Hz	125 Vrms	110 Vrms	200 Vpk
	208 Vrms	60 Hz	0.6 Hz	217 Vrms	190 Vrms	300 Vpk
	240 Vrms	60 Hz	0.6 Hz	250 Vrms	220 Vrms	400 Vpk
	347 Vrms	60 Hz	0.6 Hz	361 Vrms	318 Vrms	500 Vpk
	480 Vrms	60 Hz	0.6 Hz	500 Vrms	440 Vrms	700 Vpk
	600 Vrms	60 Hz	0.6 Hz	625 Vrms	550 Vrms	900 Vpk
CANARY IS.	127 Vrms	50 Hz	1.0 Hz	140 Vrms	107 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

NOTE: Use these thresholds to get started ***only*** *if you lack other data about acceptable power for your application.*

	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
CAYMAN IS.	120 Vrms	60 Hz	0.6 Hz	133 Vrms	108 Vrms	200 Vpk
	208 Vrms	60 Hz	0.6 Hz	229 Vrms	187 Vrms	300 Vpk
	227 Vrms	60 Hz	0.6 Hz	250 Vrms	204 Vrms	400 Vpk
	240 Vrms	60 Hz	0.6 Hz	265 Vrms	216 Vrms	400 Vpk
	480 Vrms	60 Hz	0.6 Hz	529 Vrms	432 Vrms	700 Vpk
CENT. AFRICAN REP.	220 Vrms	50 Hz	0.1 Hz	243 Vrms	187 Vrms	400 Vpk
CHAD	220 Vrms	50 HZ	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 HZ	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
CHILE	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
CHINA	220 Vrms	50 Hz	1.0 Hz	236 Vrms	204 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	407 Vrms	353 Vrms	600 Vpk
COLUMBIA	120 Vrms	60 Hz	0.6 Hz	133 Vrms	108 Vrms	200 Vpk
	240 Vrms	60 Hz	0.6 Hz	265 Vrms	216 Vrms	400 Vpk
CONGO	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
COSTA RICA	120 Vrms	60 Hz	1.2 Hz	133 Vrms	102 Vrms	200 Vpk
	240 Vrms	60 Hz	1.2 Hz	265 Vrms	204 Vrms	400 Vpk
CUBA	120 Vrms	60 Hz	1.2 Hz	133 Vrms	102 Vrms	200 Vpk
CYPRUS	115 Vrms	50 Hz	1.3 Hz	122 Vrms	108 Vrms	200 Vpk
	240 Vrms	50 Hz	1.3 Hz	255 Vrms	225 Vrms	400 Vpk
CZECHO-SLOVAKIA	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	342 Vrms	600 Vpk
DAHOMY	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 hz	419 Vrms	342 Vrms	600 Vpk
DENMARK	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	342 Vrms	600 Vpk
DOMINICA	230 Vrms	50 Hz	1.0 Hz	254 Vrms	195 Vrms	400 Vpk
	400 Vrms	50 Hz	1.0 Hz	441 Vrms	340 Vrms	600 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

NOTE: Use these thresholds to get started ***only*** *if you lack other data about acceptable power for your application.*

	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
DOMINICAN REP.	110 Vrms	60 HZ	1.2 Hz	122 Vrms	93 Vrms	200 Vpk
	220 Vrms	60 Hz	1.2 Hz	243 Vrms	187 Vrms	400 Vpk
DUBAI	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
ECUADOR	110 Vrms	60 Hz	1.2 Hz	122 Vrms	98 Vrms	200 Vpk
	120 Vrms	60 Hz	1.2 Hz	133 Vrms	102 Vrms	200 Vpk
	208 Vrms	60 Hz	1.2 Hz	229 Vrms	176 Vrms	300 Vpk
	220 Vrms	60 Hz	1.2 Hz	243 Vrms	187 Vrms	400 Vpk
	240 Vrms	60 Hz	1.2 Hz	265 Vrms	204 Vrms	400 Vpk
EGYPT	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	342 Vrms	600 Vpk
EL SALVADOR	120 Vrms	60 Hz	0.6 Hz	127 Vrms	114 Vrms	200 Vpk
	240 Vrms	60 Hz	0.6 Hz	253 Vrms	228 Vrms	400 Vpk
ETHIOPIA	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
FALKLAND IS.	230 Vrms	50 Hz	1.5 Hz	236 Vrms	224 Vrms	400 Vpk
	415 Vrms	50 Hz	1.5 Hz	426 Vrms	404 Vrms	600 Vpk
FIJI IS.	240 Vrms	50 Hz	0.5 Hz	265 Vrms	204 Vrms	400 Vpk
	415 Vrms	50 Hz	0.5 Hz	457 Vrms	352 Vrms	600 Vpk
FINLAND	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	342 Vrms	600 Vpk
	660 Vrms	50 Hz	0.5 Hz	727 Vrms	594 Vrms	1000 Vpk
FRANCE	127 Vrms	50 Hz	0.5 Hz	140 Vrms	114 Vrms	200 Vpk
	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	342 Vrms	600 Vpk
FRENCH GUIANA	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
GABON	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
GAMBIA	230 Vrms	50 Hz	1.0 Hz	242 Vrms	218 Vrms	400 Vpk
	400 Vrms	50 Hz	1.0 Hz	421 Vrms	380 Vrms	600 Vpk
GERMANY (F.REP.)	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	342 Vrms	600 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

NOTE: Use these thresholds to get started ***only*** *if you lack other data about acceptable power for your application.*

	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
GERMANY (D.REP.)	127 Vrms	50 Hz	0.5 Hz	134 Vrms	120 Vrms	200 Vpk
	220 Vrms	50 Hz	0.5 Hz	232 Vrms	209 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	400 Vrms	361 Vrms	600 Vpk
	660 Vrms	50 Hz	0.5 Hz	694 Vrms	627 Vrms	1000 Vpk
GHANA	250 Vrms	50 Hz	2.5 Hz	276 Vrms	225 Vrms	400 Vpk
	440 Vrms	50 Hz	2.5 Hz	485 Vrms	396 Vrms	700 Vpk
GIBRALTAR	240 Vrms	50 Hz	0.5 Hz	255 Vrms	225 Vrms	400 Vpk
	415 Vrms	50 Hz	0.5 Hz	440 Vrms	390 Vrms	600 Vpk
GREECE	220 Vrms	50 Hz	0.5 Hz	232 Vrms	209 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	400 Vrms	361 Vrms	600 Vpk
GREENLAND	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
GRENADA	230 Vrms	50 Hz	1.0 Hz	254 Vrms	195 Vrms	400 Vpk
	400 Vrms	50 Hz	1.0 Hz	441 Vrms	340 Vrms	600 Vpk
GUADELOUPE	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
	220 Vrms	60 Hz	1.2 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	60 Hz	1.2 Hz	419 Vrms	323 Vrms	600 Vpk
GUAM	120 Vrms	60 Hz	0.6 Hz	130 Vrms	108 Vrms	200 Vpk
	208 Vrms	60 Hz	0.6 Hz	225 Vrms	187 Vrms	300 Vpk
	227 Vrms	60 Hz	0.6 Hz	246 Vrms	204 Vrms	400 Vpk
	240 Vrms	60 Hz	0.6 Hz	260 Vrms	216 Vrms	400 Vpk
	480 Vrms	60 Hz	0.6 Hz	519 Vrms	432 Vrms	700 Vpk
GUATEMALA	120 Vrms	60 Hz	1.0 Hz	133 Vrms	108 Vrms	200 Vpk
	240 Vrms	60 Hz	1.0 Hz	265 Vrms	216 Vrms	400 Vpk
GUYANA	110 Vrms	50 Hz	1.0 Hz	122 Vrms	93 Vrms	200 Vpk
	240 Vrms	50 Hz	1.0 Hz	265 Vrms	204 Vrms	400 Vpk
	110 Vrms	60 Hz	1.2 Hz	122 Vrms	93 Vrms	200 Vpk
	240 Vrms	60 Hz	1.2 Hz	265 Vrms	204 Vrms	400 Vpk
HAITI	115 Vrms	60 Hz	1.2 Hz	127 Vrms	97 Vrms	200 Vpk
	220 Vrms	60 Hz	1.2 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	60 Hz	1.2 Hz	419 Vrms	323 Vrms	600 Vpk
HONDURAS	110 Vrms	60 Hz	1.2 Hz	122 Vrms	93 Vrms	200 Vpk
	220 Vrms	60 Hz	1.2 Hz	243 Vrms	187 Vrms	400 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

NOTE: Use these thresholds to get started **only** *if you lack other data about acceptable power for your application.*

	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
HONG KONG	200 Vrms	50 Hz	1.0 Hz	213 Vrms	188 Vrms	300 Vpk
	220 Vrms	50 Hz	1.0 Hz	234 Vrms	206 Vrms	400 Vpk
	346 Vrms	50 Hz	1.0 Hz	367 Vrms	325 Vrms	500 Vpk
	380 Vrms	50 Hz	1.0 Hz	403 Vrms	357 Vrms	600 Vpk
	346 Vrms	50 Hz	1.0 Hz	367 Vrms	325 Vrms	500 Vpk
	380 Vrms	50 Hz	1.0 Hz	403 Vrms	357 Vrms	600 Vpk
HUNGARY	220 Vrms	50 Hz	1.0 Hz	232 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	400 Vrms	342 Vrms	600 Vpk
ICELAND	220 Vrms	50 Hz	0.5 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	323 Vrms	600 Vpk
INDIA	230 Vrms	50 Hz	1.5 Hz	240 Vrms	220 Vrms	400 Vpk
	250 Vrms	50 Hz	1.5 Hz	261 Vrms	240 Vrms	400 Vpk
	400 Vrms	50 Hz	1.5 Hz	417 Vrms	384 Vrms	600 Vpk
	440 Vrms	50 Hz	1.5 Hz	458 Vrms	422 Vrms	700 Vpk
INDONESIA	127 Vrms	50 Hz	0.5 Hz	134 Vrms	120 Vrms	200 Vpk
	220 Vrms	50 Hz	0.5 Hz	232 Vrms	209 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	400 Vrms	361 Vrms	600 Vpk
IRAN	220 Vrms	50 Hz	2.5 Hz	254 Vrms	187 Vrms	400 Vpk
	231 Vrms	50 Hz	2.5 Hz	266 Vrms	196 Vrms	400 Vpk
	380 Vrms	50 Hz	2.5 Hz	438 Vrms	323 Vrms	600 Vpk
	400 Vrms	50 Hz	2.5 Hz	461 Vrms	340 Vrms	600 Vpk
IRAQ	220 Vrms	50 Hz	1.0 Hz	232 Vrms	209 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	400 Vrms	361 Vrms	600 Vpk
IRELAND	220 Vrms	50 Hz	0.5 Hz	234 Vrms	206 Vrms	400 Vpk
	230 Vrms	50 Hz	0.5 Hz	244 Vrms	216 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	403 Vrms	357 Vrms	600 Vpk
	400 Vrms	50 Hz	0.5 Hz	425 Vrms	376 Vrms	600 Vpk
ISRAEL	230 Vrms	50 Hz	1.0 Hz	244 Vrms	216 Vrms	400 Vpk
	400 Vrms	50 Hz	1.0 Hz	425 Vrms	376 Vrms	600 Vpk
ITALY	127 Vrms	50 Hz	0.5 Hz	140 Vrms	114 Vrms	200 Vpk
	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	342 Vrms	600 Vpk
IVORY COAST	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
JAMAICA	110 Vrms	50 Hz	0.5 Hz	117 Vrms	103 Vrms	200 Vpk
	220 Vrms	50 Hz	0.5 Hz	234 Vrms	206 Vrms	400 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

NOTE: Use these thresholds to get started ***only*** *if you lack other data about acceptable power for your application.*

	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
JAPAN (EAST)	100 Vrms	50 Hz	0.5 Hz	111 Vrms	90 Vrms	200 Vpk
	200 Vrms	50 Hz	0.5 Hz	221 Vrms	180 Vrms	300 Vpk
JAPAN (WEST)	100 Vrms	60 Hz	0.6 Hz	111 Vrms	90 Vrms	200 Vpk
	200 Vrms	60 Hz	0.6 Hz	221 Vrms	180 Vrms	300 Vpk
JORDAN	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
KENYA	240 Vrms	50 Hz	1.0 Hz	265 Vrms	204 Vrms	400 Vpk
	415 Vrms	50 Hz	1.0 Hz	457 Vrms	352 Vrms	600 Vpk
KOREA (NORTH)	220 Vrms	60 Hz	1.2 Hz	235 Vrms	190 Vrms	400 Vpk
	380 Vrms	60 Hz	1.2 Hz	406 Vrms	328 Vrms	600 Vpk
KOREA (SOUTH)	100 Vrms	50 Hz	1.0 Hz	111 Vrms	85 Vrms	200 Vpk
	200 Vrms	50 Hz	1.0 Hz	221 Vrms	170 Vrms	300 Vpk
	240 Vrms	50 Hz	1.0 Hz	265 Vrms	204 Vrms	400 Vpk
	415 Vrms	50 Hz	1.0 Hz	457 Vrms	352 Vrms	600 Vpk
LAOS	220 Vrms	50 Hz	4.0 Hz	234 Vrms	206 Vrms	400 Vpk
	380 Vrms	50 Hz	4.0 Hz	403 Vrms	357 Vrms	600 Vpk
LEBANON	110 Vrms	50 Hz	1.0 Hz	122 Vrms	93 Vrms	200 Vpk
	190 Vrms	50 Hz	1.0 Hz	210 Vrms	161 Vrms	300 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
LESOTHO	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
LIBERIA	120 Vrms	60 Hz	2.0 Hz	123 Vrms	117 Vrms	200 Vpk
	208 Vrms	60 Hz	2.0 Hz	212 Vrms	204 Vrms	300 Vpk
	240 Vrms	60 Hz	2.0 Hz	245 Vrms	235 Vrms	400 Vpk
	416 Vrms	60 Hz	2.0 Hz	424 Vrms	408 Vrms	600 Vpk
LIBYA	127 Vrms	50 Hz	1.0 Hz	140 Vrms	107 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	400 Vrms	50 Hz	1.0 Hz	441 Vrms	340 Vrms	600 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

NOTE: Use these thresholds to get started ***only*** *if you lack other data about acceptable power for your application.*

	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
LUXEMBOURG	120 Vrms	50 Hz	0.5 Hz	133 Vrms	108 Vrms	200 Vpk
	208 Vrms	50 Hz	0.5 Hz	229 Vrms	187 Vrms	300 Vpk
	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	342 Vrms	600 Vpk
MALAGASY REP.	127 Vrms	50 Hz	1.0 Hz	131 Vrms	123 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	227 Vrms	213 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	392 Vrms	368 Vrms	600 Vpk
MALAWI	230 Vrms	50 Hz	1.0 Hz	254 Vrms	195 Vrms	400 Vpk
	400 Vrms	50 Hz	1.0 Hz	441 Vrms	340 Vrms	600 Vpk
MALAYSIA	240 Vrms	50 Hz	0.5 Hz	253 Vrms	216 Vrms	400 Vpk
	415 Vrms	50 Hz	0.5 Hz	436 Vrms	373 Vrms	600 Vpk
MALI	127 Vrms	50 Hz	1.0 Hz	140 Vrms	107 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
MALTA	240 Vrms	50 Hz	0.5 Hz	265 Vrms	204 Vrms	400 Vpk
	415 Vrms	50 Hz	0.5 Hz	457 Vrms	352 Vrms	600 Vpk
MARTINIQUE	127 Vrms	50 Hz	1.0 Hz	140 Vrms	107 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
MAURITANIA	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
MAURITIUS	230 Vrms	50 Hz	0.5 Hz	244 Vrms	216 Vrms	400 Vpk
	400 Vrms	50 Hz	0.5 Hz	425 Vrms	376 Vrms	600 Vpk
MEXICO	127 Vrms	60 Hz	1.2 Hz	135 Vrms	119 Vrms	200 Vpk
	220 Vrms	60 Hz	1.2 Hz	234 Vrms	206 Vrms	400 Vpk
	277 Vrms	60 Hz	1.2 Hz	294 Vrms	260 Vrms	400 Vpk
	480 Vrms	60 Hz	1.2 Hz	509 Vrms	451 Vrms	700 Vpk
MONACO	127 Vrms	50 Hz	1.0 Hz	140 Vrms	107 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
MONTSERRAT	230 Vrms	60 Hz	1.2 Hz	254 Vrms	195 Vrms	400 Vpk
	400 Vrms	60 Hz	1.2 Hz	441 Vrms	340 Vrms	600 Vpk
MOROCCO	115 Vrms	50 Hz	1.0 Hz	127 Vrms	97 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

NOTE: Use these thresholds to get started ***only*** *if you lack other data about acceptable power for your application.*

	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
MOZAMBIQUE	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
NAMIBIA	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
NEPAL	220 Vrms	50 Hz	0.5 Hz	243 Vrms	187 Vrms	400 Vpk
	400 Vrms	0.5 Hz	0.5 Hz	441 Vrms	360 Vrms	600 Vpk
NETHERLANDS	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	342 Vrms	600 Vpk
NETH. ANTILLES	115 Vrms	50 Hz	1.0 Hz	127 Vrms	97 Vrms	200 Vpk
NEW GUINEA	240 Vrms	50 Hz	1.0 Hz	253 Vrms	228 Vrms	400 Vpk
	415 Vrms	50 Hz	1.0 Hz	436 Vrms	394 Vrms	600 Vpk
NEW ZEALAND	230 Vrms	50 Hz	0.8 Hz	242 Vrms	218 Vrms	400 Vpk
	400 Vrms	50 Hz	0.8 Hz	421 Vrms	380 Vrms	600 Vpk
	415 Vrms	50 Hz	0.8 Hz	436 Vrms	394 Vrms	600 Vpk
	440 Vrms	50 Hz	0.8 Hz	463 Vrms	418 Vrms	700 Vpk
NICARAGUA	120 Vrms	60 Hz	1.2 Hz	133 Vrms	102 Vrms	200 Vpk
	240 Vrms	60 Hz	1.2 Hz	265 Vrms	204 Vrms	400 Vpk
NIGER	220 Vrms	50 Hz	0.5 Hz	226 Vrms	214 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	390 Vrms	370 Vrms	600 Vpk
NIGERIA	220 Vrms	50 Hz	0.5 Hz	232 Vrms	209 Vrms	400 Vpk
	230 Vrms	50 Hz	0.5 Hz	242 Vrms	195 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	400 Vrms	323 Vrms	600 Vpk
	400 Vrms	50 Hz	0.5 Hz	421 Vrms	340 Vrms	600 Vpk
NORWAY	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	342 Vrms	600 Vpk
OMAN	240 Vrms	50 Hz	1.0 Hz	265 Vrms	204 Vrms	400 Vpk
	415 Vrms	50 Hz	1.0 Hz	457 Vrms	352 Vrms	600 Vpk
PAKISTAN	230 Vrms	50 Hz	1.0 Hz	254 Vrms	195 Vrms	400 Vpk
	400 Vrms	50 Hz	1.0 Hz	441 Vrms	340 Vrms	600 Vpk
PANAMA	120 Vrms	60 Hz	0.6 Hz	127 Vrms	114 Vrms	200 Vpk
	240 Vrms	60 Hz	0.6 Hz	253 Vrms	228 Vrms	400 Vpk
	277 Vrms	60 Hz	0.6 Hz	291 Vrms	263 Vrms	400 Vpk
	480 Vrms	60 Hz	0.6 Hz	505 Vrms	456 Vrms	700 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

NOTE: Use these thresholds to get started ***only*** *if you lack other data about acceptable power for your application.*

	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
PARAGUAY	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
	440 Vrms	50 Hz	1.0 Hz	485 Vrms	374 Vrms	700 Vpk
PERU	225 Vrms	60 Hz	1.2 Hz	248 Vrms	191 Vrms	400 Vpk
PHILIPPINES	110 Vrms	60 Hz	0.6 Hz	116 Vrms	104 Vrms	200 Vpk
	220 Vrms	60 Hz	0.6 Hz	232 Vrms	209 Vrms	400 Vpk
POLAND	220 Vrms	50 Hz	0.5 Hz	232 Vrms	209 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	400 Vrms	361 Vrms	600 Vpk
PORTUGAL	220 Vrms	50 Hz	0.5 Hz	232 Vrms	209 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	400 Vrms	361 Vrms	600 Vpk
PUERTO RICO	120 Vrms	60 Hz	0.6 Hz	133 Vrms	108 Vrms	200 Vpk
	240 Vrms	60 Hz	0.6 Hz	265 Vrms	216 Vrms	400 Vpk
	480 Vrms	60 Hz	0.6 Hz	529 Vrms	432 Vrms	700 Vpk
QATAR	240 Vrms	50 Hz	1.0 Hz	255 Vrms	225 Vrms	400 Vpk
	415 Vrms	50 Hz	1.0 Hz	440 Vrms	390 Vrms	600 Vpk
RHODESIA	225 Vrms	50 Hz	1.3 Hz	240 Vrms	210 Vrms	400 Vpk
	390 Vrms	50 Hz	1.3 Hz	416 Vrms	364 Vrms	600 Vpk
ROMANIA	220 Vrms	50 Hz	0.5 Hz	232 Vrms	209 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	400 Vrms	361 Vrms	600 Vpk
RWANDA	220 Vrms	50 Hz	0.5 Hz	232 Vrms	209 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	400 Vrms	361 Vrms	600 Vpk
ST. HELENA	230 Vrms	50 Hz	1.0 Hz	254 Vrms	195 Vrms	400 Vpk
ST. KITTS-NEVIS	230 Vrms	60 Hz	1.2 Hz	254 Vrms	195 Vrms	400 Vpk
	400 Vrms	60 Hz	1.2 Hz	441 Vrms	340 Vrms	600 Vpk
ST. LUCIA	240 Vrms	50 Hz	1.0 Hz	265 Vrms	204 Vrms	400 Vpk
	415 Vrms	50 Hz	1.0 Hz	457 Vrms	352 Vrms	600 Vpk
ST. VINCENT	230 Vrms	50 Hz	1.0 Hz	254 Vrms	195 Vrms	400 Vpk
	400 Vrms	50 Hz	1.0 Hz	441 Vrms	340 Vrms	600 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

NOTE: Use these thresholds to get started ***only*** *if you lack other data about acceptable power for your application.*

	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
SAUDIA ARABIA	127 Vrms	50 Hz	0.5 Hz	134 Vrms	120 Vrms	200 Vpk
	220 Vrms	50 Hz	0.5 Hz	232 Vrms	209 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	400 Vrms	361 Vrms	600 Vpk
	127 Vrms	60 Hz	0.6 Hz	134 Vrms	120 Vrms	200 Vpk
	220 Vrms	60 Hz	0.6 Hz	232 Vrms	209 Vrms	400 Vpk
	380 Vrms	60 Hz	0.6 Hz	400 Vrms	361 Vrms	600 Vpk
SENEGAL	127 Vrms	50 Hz	1.0 Hz	140 Vrms	107 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
SEYCHELLES	240 Vrms	50 Hz	1.0 Hz	265 Vrms	204 Vrms	400 Vpk
SIERRA LEONE	230 Vrms	50 Hz	1.0 Hz	254 Vrms	195 Vrms	400 Vpk
SINGAPORE	230 Vrms	50 Hz	0.5 Hz	237 Vrms	223 Vrms	400 Vpk
	400 Vrms	50 Hz	0.5 Hz	413 Vrms	388 Vrms	600 Vpk
SOLOMON IS.	240 Vrms	50 Hz	1.0 Hz	265 Vrms	204 Vrms	400 Vpk
SOMALIA REP.	110 Vrms	50 Hz	1.0 Hz	122 Vrms	93 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	440 Vrms	50 Hz	1.0 Hz	485 Vrms	374 Vrms	700 Vpk
SOUTH AFRICA	220 Vrms	50 Hz	1.3 Hz	232 Vrms	209 Vrms	400 Vpk
	250 Vrms	50 Hz	1.3 Hz	263 Vrms	237 Vrms	400 Vpk
	380 Vrms	50 Hz	1.3 Hz	400 Vrms	361 Vrms	600 Vpk
	400 Vrms	50 Hz	1.3 Hz	421 Vrms	380 Vrms	600 Vpk
	433 Vrms	50 Hz	1.3 Hz	455 Vrms	411 Vrms	700 Vpk
	500 Vrms	50 Hz	1.3 Hz	526 Vrms	475 Vrms	800 Vpk
SPAIN	127 Vrms	50 Hz	1.5 Hz	136 Vrms	118 Vrms	200 Vpk
	220 Vrms	50 Hz	1.5 Hz	236 Vrms	204 Vrms	400 Vpk
	380 Vrms	50 Hz	1.5 Hz	407 Vrms	353 Vrms	600 Vpk
SRI LANKA	230 Vrms	50 Hz	1.0 Hz	244 Vrms	216 Vrms	400 Vpk
	400 Vrms	50 Hz	1.0 Hz	425 Vrms	375 Vrms	600 Vpk
SUDAN	240 Vrms	50 Hz	1.0 Hz	265 Vrms	204 Vrms	400 Vpk
	415 Vrms	50 Hz	1.0 Hz	457 Vrms	352 Vrms	600 Vpk
SURINAM	115 Vrms	50 Hz	1.0 Hz	127 Vrms	97 Vrms	200 Vpk
	127 Vrms	50 Hz	1.0 Hz	140 Vrms	107 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	115 Vrms	60 Hz	1.2 Hz	127 Vrms	97 Vrms	200 Vpk
	127 Vrms	60 Hz	1.2 Hz	140 Vrms	107 Vrms	200 Vpk
	220 Vrms	60 Hz	1.2 Hz	243 Vrms	187 Vrms	400 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

*NOTE: Use these thresholds to get started **only** if you lack other data about acceptable power for your application.*

	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
SWAZILAND	230 Vrms	50 Hz	1.3 Hz	244 Vrms	216 Vrms	400 Vpk
	400 Vrms	50 Hz	1.3 Hz	425 Vrms	376 Vrms	600 Vpk
SWEDEN	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	342 Vrms	600 Vpk
SWITZERLAND	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
SYRIA	115 Vrms	50 Hz	1.0 Hz	127 Vrms	97 Vrms	200 Vpk
	200 Vrms	50 Hz	1.0 Hz	221 Vrms	170 Vrms	300 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
TAIWAN	110 Vrms	60 Hz	2.4 Hz	116 Vrms	104 Vrms	200 Vpk
	220 Vrms	60 Hz	2.4 Hz	232 Vrms	209 Vrms	400 Vpk
	380 Vrms	60 Hz	2.4 Hz	419 Vrms	342 Vrms	600 Vpk
TANZANIA	230 Vrms	50 Hz	1.0 Hz	254 Vrms	195 Vrms	400 Vpk
	400 Vrms	50 Hz	1.0 Hz	441 Vrms	340 Vrms	600 Vpk
THAILAND	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
TOGO	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
TONGA	110 Vrms	50 Hz	1.0 Hz	122 Vrms	93 Vrms	200 Vpk
	240 Vrms	50 Hz	1.0 Hz	265 Vrms	204 Vrms	400 Vpk
	415 Vrms	50 Hz	1.0 Hz	457 Vrms	352 Vrms	600 Vpk
TRINIDAD/ TOBAGO	115 Vrms	60 Hz	0.6 Hz	122 Vrms	108 Vrms	200 Vpk
	230 Vrms	60 Hz	0.6 Hz	244 Vrms	216 Vrms	400 Vpk
	400 Vrms	60 Hz	0.6 Hz	425 Vrms	376 Vrms	600 Vpk
TUNISIA	220 Vrms	50 Hz	1.0 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	342 Vrms	600 Vpk
TURKEY	220 Vrms	50 Hz	1.0 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	342 Vrms	600 Vpk
UGANDA	240 Vrms	50 Hz	0.5 Hz	251 Vrms	229 Vrms	400 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

NOTE: Use these thresholds to get started ***only*** *if you lack other data about acceptable power for your application.*

	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
UNITED ARAB EMIRATES	220 Vrms	50 Hz	0.5 Hz	225 Vrms	215 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	388 Vrms	372 Vrms	600 Vpk
	400 Vrms	50 Hz	0.5 Hz	413 Vrms	388 Vrms	600 Vpk
UNITED KINGDOM	240 Vrms	50 Hz	0.5 Hz	255 Vrms	225 Vrms	400 Vpk
	415 Vrms	50 Hz	0.5 Hz	440 Vrms	390 Vrms	600 Vpk
UNITED STATES	120 Vrms	60 Hz	0.6 Hz	128 Vrms	105 Vrms	200 Vpk
	208 Vrms	60 Hz	0.6 Hz	221 Vrms	183 Vrms	300 Vpk
	240 Vrms	60 Hz	0.6 Hz	255 Vrms	211 Vrms	400 Vpk
	277 Vrms	60 Hz	0.6 Hz	294 Vrms	243 Vrms	400 Vpk
	480 Vrms	60 Hz	0.6 Hz	509 Vrms	422 Vrms	700 Vpk
UPPER VOLTA	220 Vrms	50 Hz	1.0 Hz	203 Vrms	187 Vrms	400 Vpk
URUGUAY	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
USSR	127 Vrms	50 Hz	1.0 Hz	140 Vrms	107 Vrms	200 Vpk
	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
VENEZUELA	120 Vrms	60 Hz	1.2 Hz	133 Vrms	102 Vrms	200 Vpk
	208 Vrms	60 Hz	1.2 Hz	229 Vrms	176 Vrms	300 Vpk
	240 Vrms	60 Hz	1.2 Hz	265 Vrms	204 Vrms	400 Vpk
VIETNAM	120 Vrms	50 Hz	0.5 Hz	133 Vrms	108 Vrms	200 Vpk
	208 Vrms	50 Hz	0.5 Hz	229 Vrms	187 Vrms	300 Vpk
	220 Vrms	50 Hz	0.5 Hz	243 Vrms	198 Vrms	400 Vpk
	380 Vrms	50 Hz	0.5 Hz	419 Vrms	342 Vrms	600 Vpk
WESTERN SAMOA	230 Vrms	50 Hz	1.0 Hz	254 Vrms	195 Vrms	400 Vpk
YEMEN ARAB REP.	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
YEMEN	250 Vrms	50 Hz	0.5 Hz	261 Vrms	240 Vrms	400 Vpk
	440 Vrms	50 Hz	0.5 Hz	458 Vrms	422 Vrms	700 Vpk
YUGOSLAVIA	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

NOTE: Use these thresholds to get started ***only*** *if you lack other data about acceptable power for your application.*

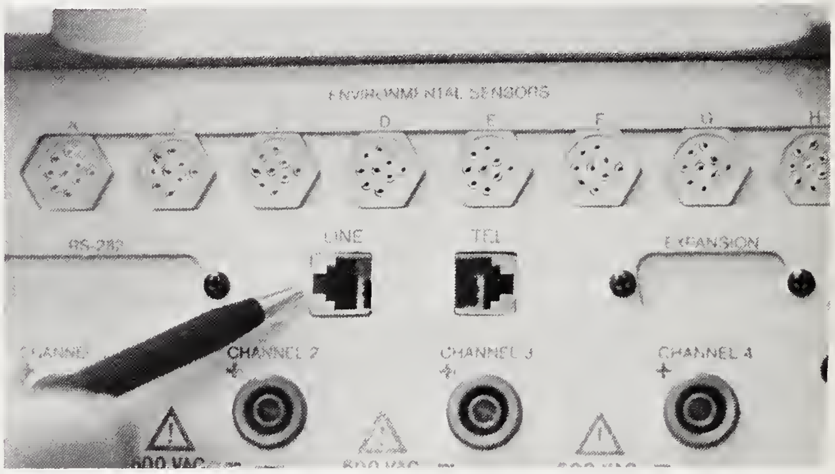
	Nominal Power		Recommended BMI PowerScope Thresholds			
	Voltage	Frequency	Frequency Tolerance	Surge	Sag	Impulse
ZAIRE	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk
	380 Vrms	50 Hz	1.0 Hz	419 Vrms	323 Vrms	600 Vpk
ZAMBIA	230 Vrms	50 Hz	1.3 Hz	239 Vrms	221 Vrms	400 Vpk
	400 Vrms	50 Hz	1.1 Hz	416 Vrms	385 Vrms	600 Vpk
ZIMBABWE	220 Vrms	50 Hz	1.0 Hz	243 Vrms	187 Vrms	400 Vpk

© 1987 Basic Measuring Instruments. All rights reserved. Telephone 415/570-5355 TWX 910-374-3059

Operating the Modem

Do you have a modem?

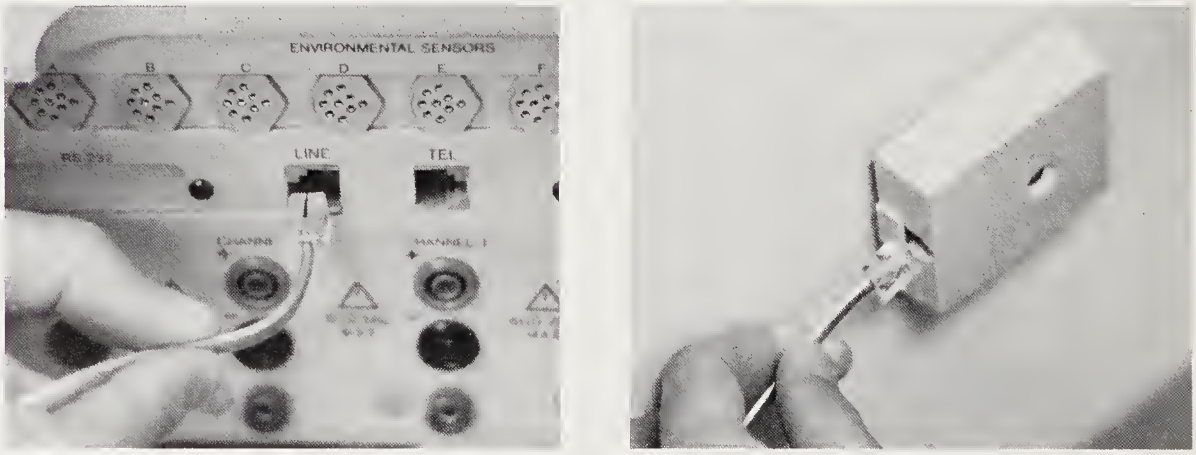
Look on the rear panel of your PowerScope. If there are connectors installed in the Line and Tel slots, you have a modem.



Connectors installed -- PowerScope is equipped with a modem. No connectors -- no modem.

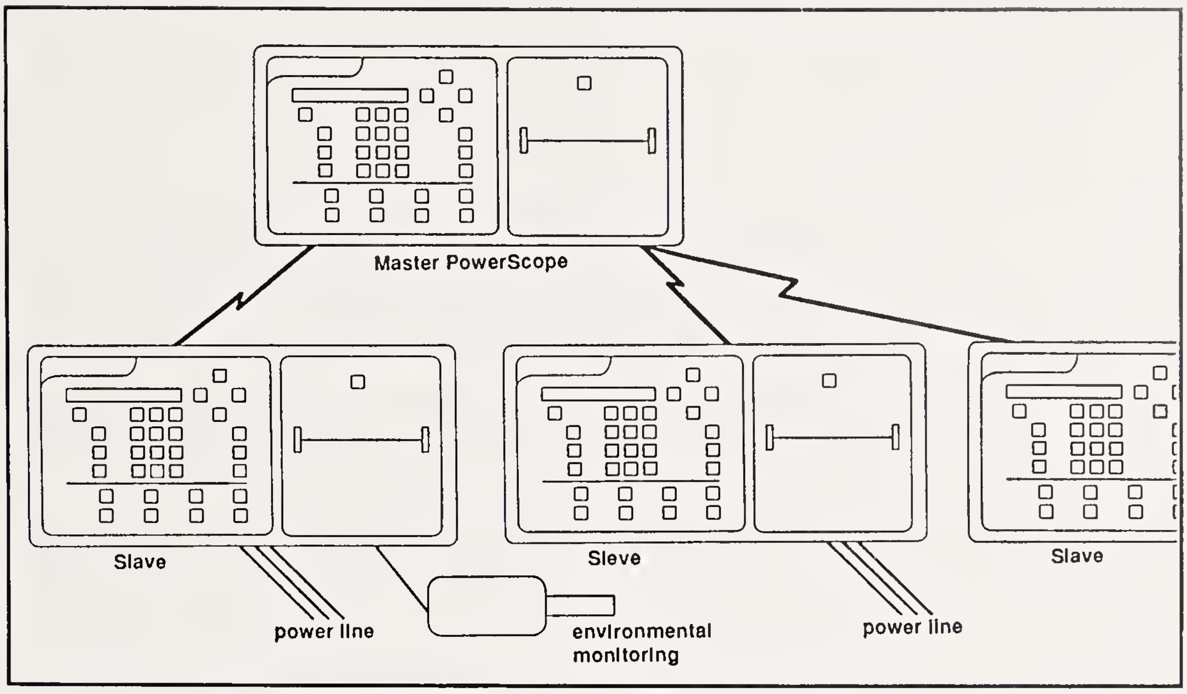
Connecting the modem

Use the RJ-11 cable supplied with your PowerScope to connect from the "LINE" connector to a standard modular telephone outlet. If you want to use a standard telephone on the same line (when the PowerScope isn't using the line), plug the telephone into the "TEL" connector.

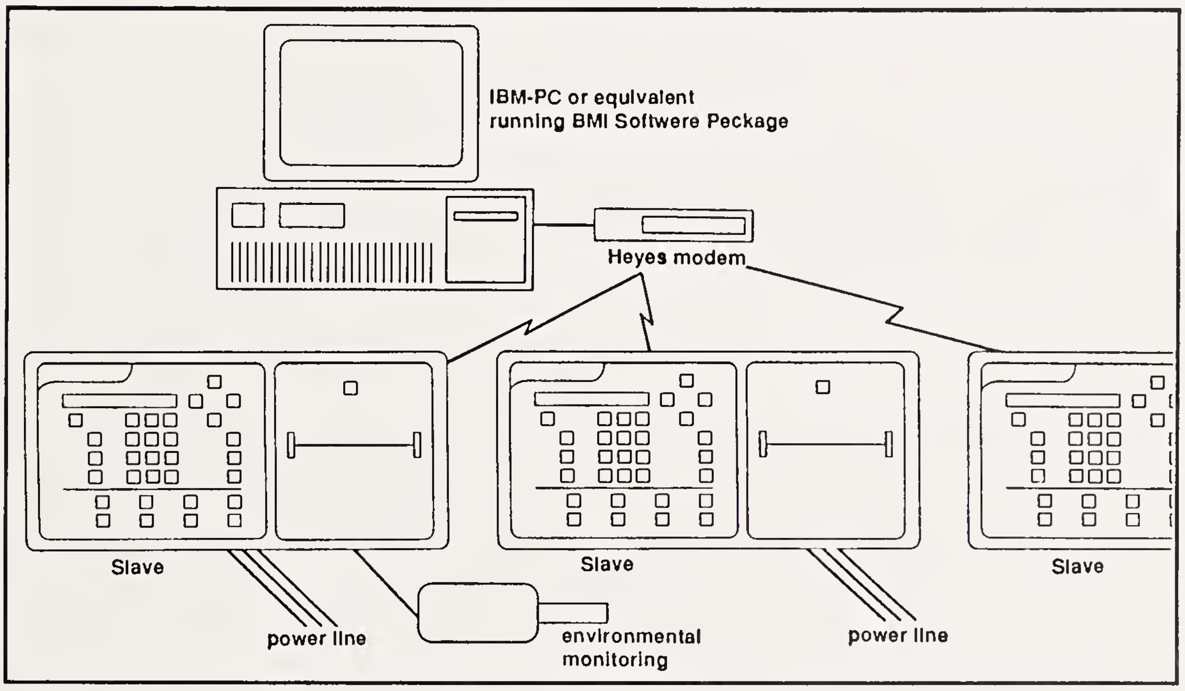


The RJ-11 cable connects the "LINE" connector on the PowerScope to the telephone outlet.

How it works



Typical PowerScope network.



Computer-controlled PowerScope network (BMI PowerNet Software, Model BMI/PC1).

How it works

The modem allows you to form a PowerScope network. Each network has one *master* PowerScope and one or more *slave* PowerScopes. Every PowerScope in the network must have a modem.

The *slave* PowerScopes monitor power and environmental disturbances, and report the disturbances to the master PowerScope.

The *master* PowerScope prints the disturbances, and controls all aspects of the the slave PowerScopes, including their Setup and Report Menus.

Typically, you'll keep the master PowerScope on your desk, and you'll have several slave PowerScopes at monitoring sites in the field.

Quick Guide to Modem Operation

1. Press SETUP MENU, then the up arrow key. Use the VALUE UP key to select "Menu: Communication".

2. Use the VALUE UP/VALUE DOWN keys to select "Port: Modem". Press the down arrow.

3. Use the VALUE UP/VALUE DOWN keys to select "Modem: Tel Numbers". Enter the names and phone numbers of all the PowerScopes in your network.

4. Decide if this PowerScope is the master PowerScope or one of your slave PowerScopes.

If it's the master PowerScope:

A. Scroll back to "Modem: Tel Numbers". Use the VALUE DOWN key to select "Modem: Type"; then select "Type: Master".

B. Choose a slave PowerScope to connect to. Your master PowerScope will call the selected slave PowerScope, and the master's keyboard, printer, and display will take over the slave's keyboard, printer, and display. (If you choose QUIT instead of a slave PowerScope, your master PowerScope will wait for a slave PowerScope to call.)

If it's one of the slave PowerScopes:

A. Scroll back to "Modem: Tel Numbers". Use the VALUE DOWN key to select "Type: Slave". Press the down arrow.

B. Choose the name of the Master PowerScope from your telephone directory, and enter it in "Master:".

C. Use the next questions to turn the slave printer off, and to hold the line for 2 minutes after transmitting data to the master.

D. You can check your phone connection to the master PowerScope.

E. Press MONITOR, then press LOCK to lock the keyboard. All disturbances will be printed at the master PowerScope.

Setting up the modem

To set up a PowerScope modem, begin by pressing the SETUP MENU key, then the up arrow.

Menu: Key Operator

Selections: Communication
Key Operator

Use the VALUE UP/VALUE DOWN keys to choose the Communication Menu. (Then press the down arrow.)

Port: Modem

Selections: RS-232
Modem
Off

Use the VALUE UP/VALUE DOWN keys to select the port you're using, in this case the Modem. When you aren't using either the modem or the RS-232 port, select Off.

Be sure to turn the modem **Off** when you aren't using it.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the Key Operator menu or the
Communication menu.  The Key Operator
menu lets you control the admini-
strative detail of your PowerScope,
including the clock and the calendar.
The Communication menu lets you
control the PowerScope modem and
RS-232 port.

(There is no more HELP!)
```

```
Use the VALUE UP/VALUE DOWN keys to
select a data communications option.
The choices are RS-232, modem or off.
It's important to choose Off when
neither port will be used.

(There is no more HELP!)
```

Modem Menu

Modem: Tel Numbers

Selections: Type
Tel Numbers
Configuration
Hang up now (only appears when master is talking to slave

Use the VALUE UP/VALUE DOWN keys to select one of the menu sections. If beginning setup, choose Tel Numbers. The choices are explained below:

If you select:

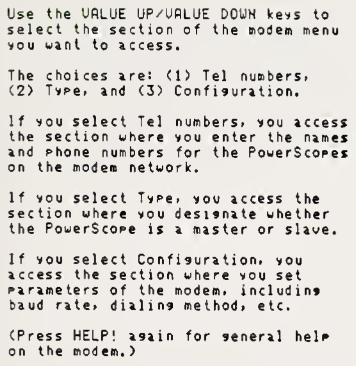
Tel Numbers - the section that allows you to enter names and phone numbers for PowerScopes in the network will be accessed. This section is further explained on page G-9.

Type - the section that allows you to designate whether a PowerScope is a slave or a master will be accessed. Use this section when you want the *master* PowerScope to call *slaves*, and when you want to control *slave* operating parameters. This section is further explained on page G-11.

Configuration - the section that allows you to control baud rate, dialing format (tone or pulse), and communication standard (BELL or CCITT) will be accessed. This section is further explained on page G-19.

Hang up now - the section that allows you to cause the *slave* to hang up and wait for the *master* to call it back will be accessed. (Another way to break connection with a slave is to put it into monitor. It will automatically hang up after a brief interval and phone back whenever it needs to print a report.) This section is further explained on page G-21.

HELP!



Use the VALUE UP/VALUE DOWN keys to select the section of the modem menu you want to access.

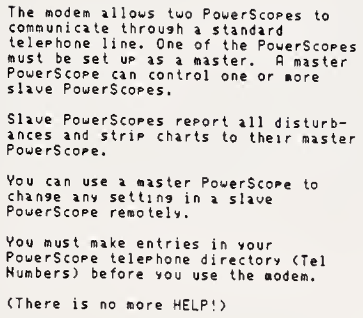
The choices are: (1) Tel numbers, (2) Type, and (3) Configuration.

If you select Tel numbers, you access the section where you enter the names and phone numbers for the PowerScopes on the modem network.

If you select Type, you access the section where you designate whether the PowerScope is a master or slave.

If you select Configuration, you access the section where you set parameters of the modem, including baud rate, dialing method, etc.

(Press HELP! again for general help on the modem.)



The modem allows two PowerScopes to communicate through a standard telephone line. One of the PowerScopes must be set up as a master. A master PowerScope can control one or more slave PowerScopes.

Slave PowerScopes report all disturbances and strip charts to their master PowerScope.

You can use a master PowerScope to change any setting in a slave PowerScope remotely.

You must make entries in your PowerScope telephone directory (Tel Numbers) before you use the modem.

(There is no more HELP!)

Modem: Tel numbers

This section allows you to enter a name and a phone number for up to 8 PowerScopes in the network. You *must* enter a list of telephone numbers before you use the modem. (If you have more than 8 PowerScopes in the network, you'll need to keep track of the extra numbers and enter them into this section when you want to contact them.)

`Modem: Tel numbers`

Selections: Tel numbers
Type
Configuration

Use the VALUE UP/VALUE DOWN keys to position "Modem: Tel numbers" in the display. Then press the down arrow.

`NAME #1: PHONE #1`

Enter up to 9 characters to name the first entry in your telephone directory. Use the left and right arrow keys to move the flashing cursor. Use the number keys to enter both letters and numbers. For example, to enter the letter A, push the '2ABC' key twice. A '2' will appear on the first push, followed by an 'A' on the second push.

Typical names are CHICAGO, SITE 23A, or HOME LAB.

`TEL #1: 111.101.1010`

Use the number keys to enter up to 34 digits for this phone number. You may enter decimal points for a two-second pause in dialing; for longer pauses put several decimal points in a row.

These questions are repeated for PowerScopes 2 through 8 in the network.

`Modem: Tel numbers`

Selections: Tel numbers
Type
Configuration

When you're finished, use the up arrow to scroll back up to the "Modem: Tel numbers" position.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the section of the modem menu you want to access.

The choices are: (1) Tel numbers, (2) Type, and (3) Configuration.

If you select Tel numbers, you access the section where you enter the names and phone numbers for the PowerScopes on the modem network.

If you select Type, you access the section where you designate whether the PowerScope is a master or slave.

If you select Configuration, you access the section where you set parameters of the modem, including baud rate, dialing method, etc.

(Press HELP! again for general help on the modem.)

Enter a name for this entry in your telephone directory.

Use the left and right arrows to move the flashing cursor. Use the number keys to enter both letters and numbers; for example, to enter the letter 'K', press the '5JKL' button three times.

(Press HELP! again for general help on the modem.)

Enter the phone number for this entry in your telephone directory.

Use the number keys to enter up to 34 digits for this phone number. You can use decimal points ('.') to indicate 2-second pauses in dialing; for longer pauses, use several decimal points in a row.

(Press HELP! again for general help on the modem.)

Use the VALUE UP/VALUE DOWN keys to select the section of the modem menu you want to access.

The choices are: (1) Tel numbers, (2) Type, and (3) Configuration.

If you select Tel numbers, you access the section where you enter the names and phone numbers for the PowerScopes on the modem network.

If you select Type, you access the section where you designate whether the PowerScope is a master or slave.

If you select Configuration, you access the section where you set parameters of the modem, including baud rate, dialing method, etc.

(Press HELP! again for general help on the modem.)

Modem: Type

This section lets you designate whether the PowerScope that's in front of you will be a *master* or a *slave*. Because "type" can only be set when you are physically in front of the keyboard (not through use of the modem), determine ahead of time which PowerScopes in the network will be *slaves*, and which *one* will be the *master*. Setup your network with these rules in mind:

- a *master* PowerScope can call (and control) *slave* PowerScopes, and can answer calls from a *slave* PowerScope
- a *slave* PowerScope can call a *master* to transmit graphs or check that it can make connection, and can answer calls from a *master* PowerScope
- a *master* PowerScope cannot call another *master* PowerScope, and a *slave* PowerScope cannot call another *slave* PowerScope

Type: Master

Type: Master

Selections: Master
Slave

Use the VALUE UP/VALUE DOWN keys to position "Type: MASTER" in the display, then press the down arrow.

HELP!

Use the VALUE UP/VALUE DOWN keys to select the section of the modem menu you want to access.

The choices are: (1) Tel numbers, (2) Type, and (3) Configuration.

If you select Tel numbers, you access the section where you enter the names and phone numbers for the PowerScopes on the modem network.

If you select Type, you access the section where you designate whether the PowerScope is a master or slave.

If you select Configuration, you access the section where you set parameters of the modem, including baud rate, dialing method, etc.

(Press HELP! again for general help on the modem.)

Type: Master

Connect to: BOSTON

Use the VALUE UP/VALUE DOWN keys to select the slave PowerScope you wish to call.

Selections: QUIT
Whatever names you entered in the "Type: Tel numbers" section

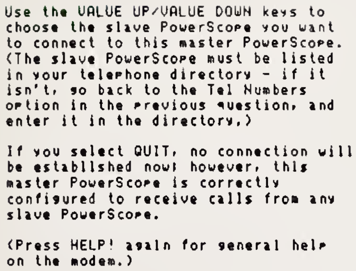
If you choose:

QUIT - no calls will be made. This *master* PowerScope will wait for a call from a *slave* PowerScope.

One of the names in your directory - and then press the down arrow, the *master* PowerScope will call that *slave* PowerScope. Once connection is established, the keys, display, and printer of the master PowerScope become the keys, display, and printer of the remote slave PowerScope. You can change the slave's Setup Menu, print its' Status Report, work with the slave's Report Menu, put the slave into monitor--in short, you can do just about anything you could do if the slave PowerScope were in front of you.

There will be minor delays as signals are sent back and forth, so the response to key strokes will be a little slower than you're used to. To break the connection: either 1) push the MONITOR key (the slave will send a threshold report and initial waveshapes, wait for a few minutes then hang up, and then will call back whenever it needs to print a graph), or 2) select "Modem: Hang up now" and press the down arrow. (The slave will wait for the master to call again.) See page G-21 for further details.

HELP!



```
Use the VALUE UP/VALUE DOWN keys to
choose the slave PowerScope you want
to connect to this master PowerScope.
(The slave PowerScope must be listed
in your telephone directory - if it
isn't, go back to the Tel Numbers
option in the previous question, and
enter it in the directory.)

If you select QUIT, no connection will
be established now; however, this
master PowerScope is correctly
configured to receive calls from any
slave PowerScope.

(Press HELP! again for general help
on the modem.)
```

Type: Slave

When you want to setup a PowerScope as a *slave*:

Type: Slave

Selections: Slave
Master

Use the VALUE UP/VALUE DOWN keys to position "Type: Slave" in the display, then press the down arrow. You can either make *slave* settings while at its' keyboard, or from the *master's* keyboard using the modem.

Type: Slave

Master: CHICAGO

Selections: None
Whatever names were entered in the "Type: Tel numbers" section

Use the VALUE UP/VALUE DOWN keys to select the *master* PowerScope for this *slave* PowerScope. The slave PowerScope will call its master every time it has a report to print. (Press the down arrow to go on to the next question.)

If you choose "None", this *slave* PowerScope will expect you to call later with the name of its *master*. Meanwhile, it will print any reports on its own printer.

Type: Slave

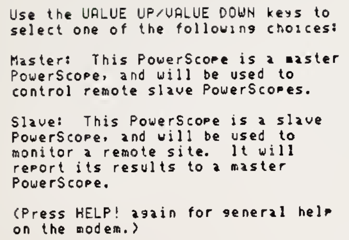
Slave printer: Off

Selections: Off
On

Use the VALUE UP/VALUE DOWN keys to turn the *slave's* printer on or off. You will usually choose **Off**. If you do choose Off, the *slave* will phone its *master* to print reports on the *master's* printer. If you choose On, all reports will be printed both on the *master's* printer and on the *slave's* printer.

Even if you choose Off, the slave will print its reports locally if it can't reach its master. This might happen if the master doesn't answer the phone, or if you've entered the wrong phone number. The slave will keep trying if it receives a busy signal for the master.

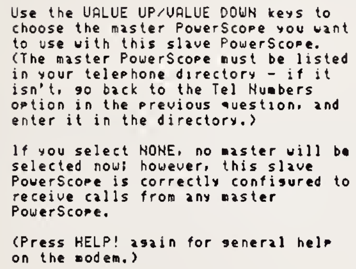
HELP!


Use the VALUE UP/VALUE DOWN keys to select one of the following choices:

Master: This PowerScope is a master PowerScope, and will be used to control remote slave PowerScopes.

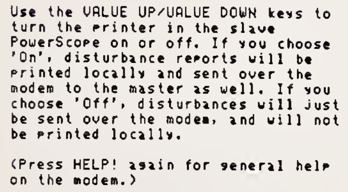
Slave: This PowerScope is a slave PowerScope, and will be used to monitor a remote site. It will report its results to a master PowerScope.

(Press HELP! again for general help on the modem.)


Use the VALUE UP/VALUE DOWN keys to choose the master PowerScope you want to use with this slave PowerScope. (The master PowerScope must be listed in your telephone directory - if it isn't, go back to the Tel Numbers option in the previous question, and enter it in the directory.)

If you select NONE, no master will be selected now; however, this slave PowerScope is correctly configured to receive calls from any master PowerScope.

(Press HELP! again for general help on the modem.)


Use the VALUE UP/VALUE DOWN keys to turn the printer in the slave PowerScope on or off. If you choose 'On', disturbance reports will be printed locally and sent over the modem to the master as well. If you choose 'Off', disturbances will just be sent over the modem, and will not be printed locally.

(Press HELP! again for general help on the modem.)

Type: Slave

Hold line for: 2 minutes

Range: 0 minutes to 99 minutes

Use the number keys to enter the length of time the *slave* PowerScope should stay on the line after it has transmitted a report. Before hanging up, it will wait this length of time to see if there are any more disturbances or other reports that should be sent to the *master*. Typical values are 2 to 5 minutes.

Type: Slave

Check line now: No

Selections: No
Yes

Use the VALUE UP/VALUE DOWN keys to choose whether you want to check the telephone connection. This can be a handy test to ensure the phone lines are of adequate quality, the master's phone number has been correctly entered, etc. If you choose "Yes", this *slave* will call its *master* and verify connection.

Modem: Type

Selections: Tel numbers
Type
Configuration

Use the up arrow to scroll back up to the "Modem: Type" question, then use the VALUE UP/VALUE DOWN keys to select "Modem: Configuration". Refer to page G-19 for an explanation of how to make these settings.

HELP!

Use the number keys to enter the length of time the slave should hold the telephone line open after it has sent a disturbance report (to save dialing charges if another disturbance needs to be sent).

The acceptable range is 0 minutes to 99 minutes. Typical value are 2 - 5 minutes.

(Press HELP! again for general help on the modem.)

Use the VALUE UP/VALUE DOWN keys to choose whether you want to check the telephone connection to the master PowerScope. If you choose 'Yes', the slave PowerScope will call the master PowerScope and verify the phone number, quality of the line, etc.

(Press HELP! again for general help on the modem.)

Use the VALUE UP/VALUE DOWN keys to select the section of the modem menu you want to access.

The choices are: (1) Tel numbers, (2) Type, and (3) Configuration.

If you select Tel numbers, you access the section where you enter the names and phone numbers for the PowerScopes on the modem network.

If you select Type, you access the section where you designate whether the PowerScope is a master or slave.

If you select Configuration, you access the section where you set parameters of the modem, including baud rate, dialing method, etc.

(Press HELP! again for general help on the modem.)

Modem: Configuration

When you want to setup a PowerScope's baud rate, dialing technique, and communication standard:

`Modem: Configuration`

Selections: Type
Tel Numbers
Configuration

Use the VALUE UP/VALUE DOWN keys to position "Modem: Configuration" in the display, then press the down arrow.

`Baud rate: 1200`

Selections: 300
1200
2400

Use the VALUE UP/VALUE DOWN keys to select the baud rate for this modem. The usual value is 1200 baud. Although lower baud rates can be used with lower quality telephone lines, the PowerScope contains sophisticated error correction schemes that allow 1200 baud to be used on virtually all lines.

The PowerScope modem automatically adjusts its baud rate; if two PowerScopes are set to different baud rates, they will both adjust to the baud rate of the PowerScope that initiated the call. 2400 baud can only be used with CCITT conditioned lines. (Press the down arrow to go on to the next question.)

`Dialing: Tone`

Selections: Pulse
Tone

Use the VALUE UP/VALUE DOWN keys to select the dialing technique for this modem. Pulse (or rotary) dialing works with virtually all direct-connection telephone lines. Tone (or DTMF) dialing may be required for access codes, requesting an outside line, etc. The usual answer is tone.

`Answer tone: BELL`

Selections: BELL
CCITT

Use the VALUE UP/VALUE DOWN keys to select the communications standard you require to transmit data. The selections are BELL 212A or CCITT V.22.

Use the VALUE UP/VALUE DOWN keys to select the section of the modem menu you want to access.

The choices are: (1) Tel numbers, (2) Type, and (3) Configuration.

If you select Tel numbers, you access the section where you enter the names and phone numbers for the PowerScopes on the modem network.

If you select Type, you access the section where you designate whether the PowerScope is a master or slave.

If you select Configuration, you access the section where you set parameters of the modem, including baud rate, dialing method, etc.

(Press HELP! again for general help on the modem.)

Use the VALUE UP/VALUE DOWN keys to select the baud rate for this modem. The available rates are 300, 1200, and 2400 baud. The usual choice is 1200 baud.

(Press HELP! again for general help on the modem.)

Use the VALUE UP/VALUE DOWN keys to select 'Pulse' (rotary) or 'Tone' (DTMF) dialing. Pulse dialing works with virtually all direct-connection telephone lines. Tone dialing may be required for access codes, requesting an outside line, etc.

(Press HELP! again for general help on the modem.)

Use the VALUE UP/VALUE DOWN keys to select the communications standard you require, CCITT V.22 or BELL 212A.

(Press HELP! again for general help on the modem.)

Modem: Hang up now

When you're on-line with a *slave* PowerScope and want it to hang up:

Modem: Hang up now

Selections: Type
Tel Numbers
Configuration
Hang up now

Use the VALUE UP/VALUE DOWN keys to position "Modem: Hang up now" in the display, then press the down arrow. The slave will hang up immediately without going into monitor mode.

HELP!

```
Use the VALUE UP/VALUE DOWN keys to
select the section of the modem menu
you want to access.

The choices are: (1) Tel numbers,
(2) Type, (3) Configuration, and
(4) Hang up now.

If you select Tel numbers, you access
the section where you enter the names
and phone numbers for the PowerScopes
on the modem network.

If you select Type, you access the
section where you designate whether
the PowerScope is a master or slave.

If you select Configuration, you
access the section where you set
parameters of the modem. including
baud rate, dialing method, etc.

If you select Hang up now, you
access the section where you can
cause a slave PowerScope to
hang up on its' master.

(Press HELP! again for general help
on the modem.)
```

Index

A

AC, see Mode: AC, 186-195

AC/DC/Impulse:
  probe, 276
  reporting, choosing, 294-297
  thresholds, 280-285

Acquisition Processor, 339

Ambient, see Temperature, Temperature/Humidity

Attenuator module, 339

Automatic zoom, E-1

B

Battery connection, 345 (See also Uninterruptible Power Supply, 310)

C

Cables, see connecting

Calendar:
  setting, 312-314

Calibration:
  module, 344
  report, 324

CANCEL PRINTER key, xii, 326

Centigrade, 308 (See also Temperature)

Clock:
  setting, 314-317

Common mode, see:
  dual-one phase, 46
  independent channels, 184
  single-phase, 2
  three-phase delta, 98
  three-phase wye, 134

Communication Menu, G-1

Computer:
  Monitoring, xvi
  Power, xv, xvi

Connecting, D-1
  see also:
    dual-one phase, 94-97
    independent channels, 256
    single-phase, 44-45
    three-phase delta, 132-133
    three-phase wye, 178-179

D

DC, see Mode: DC, 202

Date, see Calendar, 312-314

Debugging chart, 334

DEFAULT, vii, xii

Disturbances, see Graphs

Dual-One Phase, 46

E

Electronic Operating Envelope, xv

English, 298

F

Fahrenheit, 308 (See also Temperature)

Frequency:
  reporting, choosing for:
    dual-one phase, 82-83
    independent channels, 236
    single-phase, 32-33
    three-phase delta, 126-127
    three-phase wye, 166-167
  tolerance, setting for:
    dual-one phase, 54-55
    independent channels, 190-191
    single-phase, 8-9
    three-phase delta, 104-105
    three-phse wye, 140-141

French, 298

Front panel, 343

Fuse holder, iv

G

Graphs:
  High-frequency noise, xv
  Humidity, xv
  Impulse, xv, E-4
  Radio-frequency interference, xv
  Resolution, E-2
  Sag/Surge, xv, E-3
  Strip charts, xv, E-2
  Temperature, xv

H

HELP:
  key, vii, xiii
  messages, vii, 298

Helpful Hints, xvi

High-frequency noise:
  reporting, choosing for:
    dual-one phase:
      L-N, 80, 81
      N-G, 88, 89
    independent channels:
      AC, 234, 235
      DC, 244, 245
      N-G, 252, 253
    single-phase:
      L-N, 30, 31
      N-G, 36, 37
    three-phase delta, 126, 127
    three-phase wye:
      A-N, 162, 164
      N-G, 174, 175
  thresholds, setting for:
    dual-one phase, 68, 69
    independent channels:
      AC, 198, 199
      DC, 212, 213
      N-G, 220, 221
    single-phase, 20, 21
    three-phase delta, 112, 113
    three-phase wye, 152, 153

High-resolution, see Wave: resolution

Humidity:
  Probe, 264, 302
  Rate-of-change, 270
  Reporting, choosing, 290-293
  Threshold, 266-273

Hysteresis, 304

I/O processor, 341

Idle, iv

Impedence:
  setting, 308

Impulse:
  automatic full-scale ranging table, 60, 64, 110, 146, 150, 210
  capture, 340
  graphs, xv, E-4
  manual full-scale ranging table, 60, 64, 110, 146, 150, 210
  range, setting for:
    AC/DC/Impulse probe, 284
    automatic or manual, 306
    dual-one phase:
      L-N, 60, 61
      N-G, 92, 93
    independent channels:
      AC, 196, 197
      DC, 210, 211
      N-G, 218, 219
    single-phase:
      L-N, 14, 15
      N-G, 42, 43
    three-phase delta, 110, 111
    three-phase wye:
      L-N, 146, 147
      N-G, 176, 177
  reporting, choosing for:
    dual-one phase, 86, 87
    independent channels:
      AC, 240, 241
      DC, 248, 249
      N-G, 254, 255
    single-phase, 36, 37
    three-phase delta, 130, 131
    three-phase wye, 170, 171
  threshold, setting for:
    dual-one phase, 58, 59
    independent channels:
      AC, 194, 195
      DC, 208, 209
      N-G, 216, 217
    single-phase, 12, 13
    three-phase delta, 108, 109
    three-phase wye, 144, 145
  thresholds, suggested, F-1

Independent channels, 180, (See also Mode)
  naming, 188, 189, 204, 205

Initial waves, see Initial Waveshape Report

Initial Waveshape Report:
  normal/high resolution, 302
  turning on for:
    dual-one phase, 74, 75
    independent channels, 228, 229
    single-phase, 24, 25
    three-phase delta, 118, 119
    three-phase wye, 158, 159

K

Key Operator Menu, xiii, 298, C-1

Keyboard:
  function of keys, xii
  locking and unlocking, 322

L

Language:
  HELP messages, 298

Line-to-neutral, see:
  dual-one phase, 46
  independent channels, 184
  single-phase, 2
  three-phase delta, 98
  three-phase wye, 134

LOCK key, xii, 322

M

Mathematics processor, 341

Mechanical construction, 346

Memory:
  graph, E-4
  naming, 318
  protecting, 318

Menus:
  Communication, G-5
  Key Operator, xiii, 298, 299, C-1
  Report, xiii, 73, B-1
  Setup, xiii, 5,49, A-1

Mode:
  Independent channels:
    AC, 186-195
    DC, 202, 203
    N-G, 214, 215
    OFF, 222, 223

Modem, 344, G-1

MONITOR, xii, xvi, 320

Monitoring:
  computers, xvi
  high-voltage, xviii
  preventive, xviii

Mother board, 343

N

Nominal frequency:
  setting for:
  dual-one phase, 54, 55
  independent channels, 190, 191
  three-phase delta, 104, 105
  three-phase wye, 140, 141

Neutral-to-Ground:
  impulse:
  automatic ranging table, 18, 64, 150
  manual ranging table, 18, 64, 150
  range, setting for:
    dual-one phase, 64, 65
    single-phase, 18, 19
    three-phase wye, 150, 151
  surge threshold, setting for:
    dual-one phase, 62, 63
    single-phase, 16, 17
    three-phase wye, 148, 149

Normal mode, see:
  dual-one phase, 46
  independent channels, 184
  single-phase, 2
  three-phase delta, 98
  three-phase wye, 134

P

Paper:
  changing paper rolls, 330-332

Phase:
  dual-one phase:
    settings for A or B, 52, 53, 66, 67

Power:
  conditioner:
    checking effectiveness of, xvii
    measuring output of, 96-97
    sizing, xvii
  failure, see Uninterruptible Power Supply, 310
  supply, 346
  tolerance of electronic equipment, xiv
  type:
    designating:
      dual-one phase, 50, 51
      independent channels:
        AC, 186, 187
        DC, 202, 203
        N-G, 214, 215
        Off, 222, 223
      single-phase, 6, 7
      three-phase delta, 102, 103
      three-phase wye, 138, 139

Print:
  strip charts, vii, 320

Printer:
  assembly, 342
  interface, 342
  paper, 330

R

Rms:
  mode for AC/DC/Impulse probe, 278
  reporting, choosing for:
    dual-one phase:
      L-N, 78, 29
      N-G, 88, 89
    independent channels:
      AC, 232, 233
      DC, 242,
      N-G, 250, 251
    single-phase:
      L-N, 28, 29
      N-G, 38, 39
    three-phase delta, 122, 123

  - three-phase wye:
    - A-N, 162, 163
    - N-G, 172, 173

Radio frequency:
  - interference, 272
  - probe, 272
  - range, 274
  - reporting, choosing, 292-295
  - surge, 274
  - threshold, 274-275

RECALL MEMORY key, xii, 328

Relative humidity, see Humidity

reset, xi

S

Sag voltage: (See also Graphs)
  - setting threshold for:
    - dual-one phase, 56, 57
    - independent channels:
      - AC, 192, 193
      - DC, 206, 207
    - single-phase, 10, 11
    - three-phase delta, 106, 107
    - three-phase wye, 142, 143

SELF CALIBRATE key, xii, 324

SELF TEST:
  - key, 324
  - report, 324

Sensor:
  - setup, 258

Setup Menu, xiii, A-1, see:
  - dual-one phase, 46
  - independent channels, 184
  - single-phase, 2
  - three-phase delta, 98
  - three-phase wye, 134

Single-phase, 2

Site:
- naming:
  - dual-one phase, 48, 49
  - independent channels, 186, 187
  - single-phase, 4, 5
  - three-phase delta, 100, 101
  - three-phase wye, 136, 137

Software, 338

Status:
- key, xii, 322
- Report:
  - dual-one phase, 95
  - independent channels, 256
  - single-phase, 45
  - three-phase delta, 133
  - three-phase wye, 179

STORE MEMORY key, xii, 326

Strip charts: (See also Graphs)
- erasing, vii, 320
- reports, 26, 76, 120, 160, 230

Summary reports:
- Printing or Clearing, 2, 3, 22, 23, 46, 47, 70, 71, 98, 99, 114, 115, 134, 135, 154, 155, 180, 181, 224, 225

Supply voltage:
- setting, iv

Surge voltage: (See also Graphs)
- full-scale range, 10, 56, 106, 142, 192, 216, 280
- setting threshold for:
  - AC/DC/Impulse probe, 280
  - dual-one phase, 56, 57
  - independent channels:
    - AC, 192, 193
    - DC, 206, 207
    - N-G, 216, 217
  - single-phase, 10, 11
  - three-phase delta, 106, 107
  - three-phase wye, 142, 143

T

Temperature:
  Centigrade or Fahrenheit, 308
  Probe, 258, 345
  Rate-of-change, 262
  Reporting, choosing for, 286-289
  Threshold, 260-263

Temperature/Humidity:
  Probe, 264, 345
  Rate-of-change, 268, 270
  Reporting, choosing for, 290-293
  Threshold, 266-273

Three-phase delta, 98

Three-phase wye, 134

Thresholds:
  recommended, xvi, F-1

Threshold Report:
  dual-one phase, 72, 73
  independent channels, 226, 227
  single-phase, 24, 25
  three-phase delta, 116, 117
  three-phase wye, 156, 157

Time, see Clock, 314

Transverse, see:
  dual-one phase, 46
  independent channels, 184
  single-phase, 2
  three-phase delta, 98
  three-phase wye, 134

Troubleshooting, 334

Type:
  Power type: see
    dual-one phase, 50
    independent channels, 184
    single-phase, 6
    three-phase delta, 102
    three-phase wye, 138

U

Uninterruptible power supply, 310

Unlocking the keyboard, xii, 322

V

Vdc:
  mode for AC/DC/Impulse probe, 278

Voltage: (See also Sag voltage, Surge voltage)
  supply, iv
  thresholds, recommended, F-1

W

Wave: (See also Waveshape fault)
  resolution, 302
  tolerance, 300

Waveshape fault: (See also Graphs)
  detection, 340
  reporting, choosing for:
    dual-one phase, 84, 85
    independent channels:
      AC, 238, 239
      DC, 246, 247
    single-phase, 34, 35
    three-phase delta, 128, 129
    three-phase wye, 168, 169
  specifying:
    amplitude, 300
    duration, 300
    tolerance, 300

Z

Zoom, Automatic zoom, E-1

Your comments please

Please help us to improve our products and publications. After you review this manual, please take a moment to answer the questions below.

1. How would you rate the following?	Very Easy	Fairly Easy	Fairly Difficult	Very Difficult
a) Ease of reading this manual.	☐	☐	☐	☐
b) Ease of locating information in the manual.	☐	☐	☐	☐
c) Ease of learning to use the PowerScope.	☐	☐	☐	☐

2. What areas of difficulty have you found in learning to use the BMI PowerScope?

____

____

3. What changes would you recommend?

____

____

4. How frequently do you face power problems in which you expect to use the BMI PowerScope?

Daily, On-Going	Few Times Per Week	Few Times Per Month	Less than Once Per Month
☐	☐	☐	☐

5. For which specific applications do you anticipate using the BMI PowerScope? (e.g., monitoring power conditioner output, DC, computers, etc.)

____

____

6. Please list any comments or suggestions you may have that would help us provide better service.

____

____

____

BMI
355 Lakeside Drive
Foster City, CA 94404

Attn: MARKETING

(FOLD HERE)

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 2149 SAN MATEO, CA

POSTAGE WILL BE PAID BY ADDRESSEE

Basic Measuring Instruments
335 Lakeside Drive
Foster City, CA 94404-1161

Attn: MARKETING

(FOLD HERE)

Acknowledgments

Hardware Engineering	Fred Nitz, Alex McEachern, Steve Terry, Lillian Kozned, Miguel Bugarini
Software Engineering	Fred Nitz, Alex McEachern, Steve Terry, Fred O'Leary, Steve Ni, Mike Nelson, William Kraznansky, Susan Martin
Industrial Design	John Clelland
Mechanical Design	John Clelland, Phil Diaz, Don Geri
Very useful ideas	Steve Tharp, Bob Moore, Christine Mihelich, Joe Kirkup, Maurice Tetreault, Roland Hahn, Tom Key, Fred Kalbach, Warren Lewis, BOGSAT, John Roberts, Dick Jablecki, Henry Sanchez, Tom Crittenden, Dave Zack, Tony Lamport, Steve Schuemer, Jack Andresen, CBEMA
This manual	Designed and produced by John Clelland, written and edited by Ann Scheuerell and Alex McEachern

PROPERTY OF UNISYS
2276 HIGHCREST ROAD
ROSEVILLE, MN 55113

BMI

Basic Measuring Instruments
335 Lakeside Drive
Foster City, California 94404
U.S.A.
TEL 415. 570. 5355
TWX 910. 374. 3059

BMI
Customer Service Department
California - 800. 451. 3040
Outside California - 800. 634. 1233